MONETARY POLICY, WAGE RATES, AND PRODUCTIVITY IN THE UNITED STATES AND UNITED KINGDOM, 1970 TO 1990

BY

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Abstract of Dissertation Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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This dissertation appears against a broad background of literature in economics concerning uses of statistical methods, and Milton Friedman and Anna Schwartz's Monetary Trends in the United States and the United Kingdom (1982). At the time of the publication of Monetary Trends, Charles Goodhart took note of the unusual use of statistical methods in a review article, and afterward econometricians Hendry and Ericsson attacked the Friedman and Schwartz approach.

William Frazer also had pointed to Friedman's departure from the econometrician's uses of statistical methods in a 1983 article and undertook further study of Friedman's uses of statistical methods. This became a part of Frazer's discussion of Friedman's use of statistical methods in Power and Ideas (1988). He saw that Friedman not only offered an alternative way of analyzing the statistical data but that he

had a total alternative analytical system which extended to the use statistical methods.

Against this background, we undertook analyses of data for both the U.S. and the U.K., asked specific questions, and offered specific hypotheses as we considered the data for the 1970s and 1980s decades. At the juncture of the two decades, the policies of the U.S. and U.K. take redirection and appear as what Frazer calls "The Big U-Turn." In broad outline the policy moves from monetary accommodation to monetary discipline.

Drawing on Friedman's uses of analysis and statistical methods, we see these two distinct decades of policy as episodes which impact on the time series we undertook for study. Along this route, some further support arises for a prior hypothesis namely:

> Hypothesis 1: The United Kingdom and the United States have in common the same determinants of the money demand functions.

The additional hypotheses we presently address are as follows:

> Hypothesis 2: Nominal wage rates adjust more readily in the presence of monetary discipline.
>
> Hypothesis 3: Wage rates are determined by productivity and market structures irrespective of monetary policy.
>
> Hypothesis 4: Standard econometric methods are appropriate for analysis of the time series we deal with, the hypotheses we confront, and the treatment of episodes of the kind we encounter for the decades of the 1970s and 1980s.

Given the approach we adopt, the statistical results reported support hypothesis 2, but not hypotheses 3 and 4.

CHAPTER 1
INTRODUCTION

1.1 Introduction

William Frazer has identified alternative analytical systems which appear in economics over the post-World War II years (Frazer 1988, 453-456; 1991a), and which share some claim to being "positive economics" as Friedman discussed it (Frazer and Boland 1983; Friedman 1953). In addition, He has traced out alternative ways of treating probability as it enters into the alternative systems (Frazer 1988, 67-68). Looking only at the analytical systems, Frazer narrows the treatment to Friedman's system and to the Keynesian/post-Keynesian system. He focuses the analysis on policy-oriented questions and approaches associated with Keynes's economics and Friedman's economics.[1]

Injecting the use of probability, Frazer finds that Friedman adopts a Bayesian (or subjective) probability in his analytical approach, and that the Keynesians come closest to

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[1] Frazer's most recent work in this respect is A European Monetary System (1991b). Drawing on the material in this 1991b study and a wide range of previous policy-oriented studies (e.g., Frazer 1967; 1973; 1978; 1988), Frazer concludes in the 1991b study that the Keynesian/post-Keynesian system and Friedman's are the only alternatives that have any meaningful visibility at policy levels in the 1980s and in the 1990s as plans for a new European monetary system appear.

identifying with what Milton Friedman and Anna Schwartz (hereafter F/S) called "the prevailing fashion in econometric work" (Frazer 1988, 79; F/S 1982, 629). In "the prevailing fashion in econometric work" the more classical probability enters. Statistical results are obtained as if the data under analysis were drawn from an unchanging universe where episodes play a very secondary role. Often the only role the episodes play appears as a dummy variable in assessing the information obtained by the use of the statistical methods.

In Friedman's case, episodes play a main role in moving the time series about, and the behavioral units (the firms, households, and individuals) are in the position of learning and adjusting to them as behavioral units move through time. Further, Friedman's search with respect to the time series was for a stable relation, so he consequently set about distinguishing between information in the time series that was transitory and information that was more permanent. The major, first study along this line was A Theory of the Consumption Function (1957), from which comes "the permanent income hypothesis." "Permanent" became synonymous with "trend" (the "trend" component in the data), as F/S undertook such works as the Monetary History (1963) and Monetary Trend (1982).

In even these early studies, adjustments to the time series for "episodic change" began to appear in the time series spanning a hundred years or more. As studies continued

and matters evolved, the "episodic change" dimension became more complicated. Particularly it did so as the U.S. and the U.K. undertook particular policy control actions which may be said to be based on Keynesian economics. The major sorts of episodic changes Friedman started to point to as the post-World War II years drew on were with respect to "psychological time,"[2] and changes in the structure underlying the formation of inflationary expectations which Friedman dated from the mid 1960s in both the U.S. and the U.K. (F/S 1982, 569-573).

In general terms episodes became equated with "exogenous" (to use a technical term) influences, and debate arose over the treatment of monetary policy as being an outside (or exogenous) event. It did so as a part of what became the causation debate which took up uses of statistical methods (Frazer 1973, 126-129) and which Lord Kaldor extended to institutional considerations (Frazer 1983; 1988, 97-98, 545, 729-730; 1991a, chap.3).

Frazer, too, picked up on Bayesian probability, learning on the part of the behavioral entities, and monetary policy. Initial discussion appeared in 1973 (sect. 8.2) and a more formal piece appeared in 1978 (Frazer 1978).

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[2] "Psychological time" (Frazer 1988,742) refers to an episode (or a policy-induced episode) such as the stock market crash of 1987 (Frazer 1988, 683-686) where the behavioral units form expectations by examining the current condition and analogizing it to a past similar episode such as the stock market crash of 1929.

Starting with a 1984 interview with Friedman, Frazer sought to give more order to Friedman's uses of Statistical methods (Frazer 1988, chap.18; and Frazer and Sawyer 1984). He later identified Friedman's early monograph titled "The Interpolation of Time Series by Related Series" (1962) as representative of this orientation.

Along this line of inquiry what we end up with are the following points: (1) Friedman's search was for stable phenomena and not "flat out" stability in the relation (Frazer 1984). (2) The impacts of nonrepetitive changes on the time series must be separated from those that can be said to be repetitive. (3) Episodes impact on the time series in all of the main time frames we adopt, namely, the very short run, the transitory period (or short cycle emphasized by Friedman), and the long run (i.e., Friedman's permanent or "trend" components). They do so particularly in the highly volatile states of the 1970s and 1980s. (4) Central bankers in particular are interested in reacting to liquidity shifts bearing on the very short run (e.g., the stock market crash of 1987), the stabilization of business conditions (i.e., transitory change), and the attainment of economic growth (i.e., Friedman's permanent components). (5) The decades of the 1970s and the 1980s are decades in which monetary policies of a very different sorts were imposed on the time series from outside of the system of time series, particularly those for prices, wages, and productivity. With respect to the latter,

we take up the definitions below of "monetary accommodation" and "monetary discipline."

A further aspect of Frazer's treatment of alternatives analytical systems, which will be of later interest, is that Friedman's system has its own microeconomic foundations. Along this line, Friedman rejects the theories of market structures which appeared since the 1930s (Frazer 1988, chap. 9). He goes back to Keynes of the 1920s and to some extent Keynes of the 1930s, but he proceeds very differently with special time frames and all, and very differently from the Keynesian/Post-Keynesian alternative. As we have stated, the special time frames include the long run (the trend component of the time series), the transitory (or cyclical) component of the series, plus there is a place for episodic changes. To be sure, monetary policy itself may be viewed as an outside event (as "exogenous" to use a technical term) which receives attention in Appendix A.

1.1.1 Causation, Accommodation and Discipline

The issue of causation in this monetary, statistical, policy-oriented economics, spans over decades and reduces to the question of whether money growth (M^0) causes income growth (Y^0) with feedback or whether the income growth causes the money growth (ΔY^0 -->ΔM^0.)(Frazer 1973, 125-131; 1991a, sect.3.5; and 1991b),. It reduces to a very specific set of policy operations where we have the central bank controlling the money stock independent of fiscal policy and interest

rates, à la Friedman, or whether fiscal policy (defined as a deficit) becomes the principal control means with the central bank simply accommodating the control.

The distinctions between Friedman's alternative and the Keynesian/Post-Keynesian system goes beyond the time frames, the uses of statistical methods; it extends to issues of causation, and the role of the government and central bank operations as most recently addressed by Frazer (1991b). These differences are what we portray as monetary accommodation, $(\Delta M^0 * 100)(Y/M)>0$, and monetary discipline, $(\Delta M^0 * 100)(Y/M)<0$. In this distinction ΔM^0 signifies monetary acceleration, $-\Delta M^0$ signifies deceleration, and Y/M is income velocity of money. It indicates the extent of the final impact on spending of the acceleration (or deceleration).

There is more, but this introductory review serves only to point out that the present work focuses more narrowly on Friedman's approach, the Keynesian /Post-Keynesian alternative, and particularly undertakes to engage in statistical analyses of data which we identify with Friedman as opposed to "the prevailing fashion in econometric work" (Frazer 1988, 79; F/S 1982, 629). Along this line, we may point to hypotheses 1 and 4 below.

1.1.2 The Four Hypotheses

The present study are four hypotheses, they are:

Hypothesis 1: The United Kingdom and the United States have in common the same determinants of the money demand functions (F/S 1982, sect. 5.4).

Hypothesis 2: Prices and nominal wage rates adjust more readily in the presence of monetary discipline. (We recall that Keynes pointed to "sticky wage" in the 1920s and based his General Theory on the notion of a wage standard i.e., that wages would remain tied to productivity growth as total spending was managed to achieve Keynesian full employment.)[3]

Hypothesis 3: Wage rates are determined by productivity and market structures irrespective of monetary policy. [This we associate later (sect. 4.1.2) with a theorem due to Sidney Weintraub and Stephen Rousseas. We use it in reference to the post Keynesian theory of an "endogenous" money supply.]

Hypothesis 4: Standard econometric methods are appropriate for analysis of the time series we deal with, the hypotheses we confront, and the treatment of episodes of the kind we encounter for the decades of the 1970s and 1980s. [This statement gains further significance from the reliance of these methods on sampling from an unchanging universe over a long period of time. The analytical problems here are associated with what Frazer calls " the separation of effects " problem (1991a sects 2.4b and 2.5) and with the classification of variables as endogenous.]

The first of these hypothesis was very much supported by F/S's Monetary Trends(1982). A Major result of the findings giving rise to the statement was that no conditions special to one of the countries needs to be brought into discussion as far as the empirical findings are concerned.

Hypothesis 2 gains its importance for having been introduced by J. M. Keynes in the 1920s, in the form of the issue of sticky prices and the special price called the wage. As built into Keynes's General Theory (1936), the idea is in

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[3] We see this as being widely accepted, but Sir John Hicks offers discussion of this position (Hicks 1983).

two parts; that nominal wages (and thus prices) do not adjust downward in the presence of inadequate demand for production (say, because of a shift in liquidity); and that production adjust downward rather than price. Were the prices to adjust, demand for the current output would be restored and full employment production attained. With unemployment in the presence of what was perceived as a failure of monetary policy, the economic-policy solution to unemployment was in terms of fiscal policy. The failed view of monetary policy pertained to the Keynes/Keynesian monetary policy linkages where reliance focused upon interest rates as the control variables (Frazer 1991a chaps. 3 and 4). The combination of the perceived failure of monetary policy, and the fiscal policy on the positive side is where we get monetary policy with the purpose of accommodating price increase and deficit spending, such as we encounter in the U.S. and the U.K. in the 1970s, and at the hands of Lord Kaldor (1982, 42-60).

As reviewed by Frazer, Friedman's orientation toward monetary policy was taken up by Ronald Reagan in the United States as a part of what was called "supply-side economics" (Frazer 1988, chap. 16). The same control arrangement was called "monetarism" in the U.K., where Friedman's influence was also felt (Frazer 1988, chap.14 and 15). The idea in both cases was to use monetary policy to tame inflation (and hence in general bring about a downward adjustment in the inflation rate which had gotten built into pricing policy and wage

contracts in the 1970s). Thus, the economics and the political positions found in the U.S. and the U.K. in the 1980s are linked togather.

Hypothesis 3 gains its place in the present study because of its strong link with the monetary accommodation view which we see as principally Keynesian/post-Keynesian. In contrast to Friedman's monetarist view, the explanation for inflation resides in theories of market power, and no attention at all is given to monetary matters as a means of stabilizing the price average. So once again the distinction we encounter between the decades of the 1970s and 1980s, and monetary accommodation and discipline extend readily to the attention we give hypothesis 3.

Hypothesis 4 gains its place in this study because Friedman adopts a Bayesian (or subjective) probability in his analytical approach, and the Keynesians come closest to identifying with "the prevailing fashion in econometric work" method. In Friedman's case, episodes play a main role in moving the time series about (sect. 1.1). On the other hand, the "the prevailing fashion in econometric work" approach obtains statistical results as if the data under analysis were obtained from an unchanging universe and episodes play a very secondary role.

In confronting "the prevailing fashion in econometric work," special analytical problems in analyses of data arise. One is that dealing with solutions for variables internal to

the model in term of variables called "exogenous" which are outside of the model, and another is that with the separation of effects in the multiple regression case. As will ne taken up in the next chapter (sect. 2.3), the separation of effects comes down to whether the so-called independent variables in a multiple regression are in fact independent, plus there is the Leamer problem of setting limits on the true regression coefficients in such models (Leamer 1985).

With these analytical matters in mind, Friedman offers a different way to proceed. His uses of method are simple and indirect and offer several main prospects. One of these is the prospect of allowance for the impact of episodes on the time series. Closely related is the prospect that information is being obtained from a changing universe. Also there is the prospect that no variable is entirely "endogenous" or "exogenous" by the definitional standards the econometricians have set (appendix A).

We will not deal with all of this in great detail, since it appears elsewhere (Frazer 1988; 1991a and 1991b), but we bring to the forefront the presence of "episodic change" in the time series. On the one hand, we see it as a problem in the use of "the prevailing fashion in econometric work" (Frazer 1988, 79; F/S 1982, 629), and, on the other, the use of methods found in Friedman's approach elevates the importance of episodic changes and highlights sampling from different universes.

1.2 Episodic Change and Exogeneity

Substantial changes in time series may occur from developments outside the system of equations which econometric technique made fashionable. This encountervailing view appears along two lines: (1) the main regime shifts we point to and (2) the approach Friedman took to monetary policy as an "exogenous" variable (appendix A). Indeed, he even made the analogy to "helicopter" money in explaining his view of money whereby routine drops of twenty dollar bill on the community by the helicopter (Frazer 1991a, chap 3; 1991b, sect.2.1c) would lead to additional spending (hence, $\Delta M^0 \rightarrow \Delta Y^0$, or conversely $-\Delta M^0 \rightarrow -\Delta Y^0$).

In the first instance, there are "shocks" impacting on numerous time series of the type we take up, although we do recognize that some "shocks" may not be entirely independent of the time series themselves. The sorts of "shock" Frazer cites most often may be illustrated by the following list: (1) the political regime shifts such as occurred in the United States and the United Kingdom with Reagan and Thatcher, respectively; (2) the numerous announcement in the 1970s, first by Richard Nixon and then Jimmy Carter, about price controls; (3) President Nixon's announcement in 1971, about the U.S.'s intention of no longer supporting the U.S. dollar with gold; (4) oil-cartel pricing which first appeared in 1973; (5) the Iranian crisis and related oil pricing in 1979; (6) Ronald Reagan's confrontation with the air traffic

controllers in the spring of 1981; (7) Margaret Thatcher's confrontation with the British coal miners on successive occasions; (8) Reagan's attacks on the Federal Reserve in the early 1980s to bring about some of the results we see as monetary discipline; (9) news reported through the U.S. Treasury's secretary in 1985 and on later occasion to the effect that the U.S. would allow the dollar to decline in price in the foreign exchange market rather than to pursue further deceleration of inflation rates; (10) the stock market crash of 1987; (11) Reagan's and Greenspan's announcement at the October 1987 date that Federal Reserve would not repeat the mistakes of the past and the subsequent appearance of open market purchases in New York by the Fed; and (12) the privatization of British state-owned industry in the second half of the 1980s; (13) the Iraqi invasion of Kuwait in 1990.

In our examination of episodes, we adopt Friedman's view that monetary policy itself is an impact on the economic system from outside (i.e., the view of ΔM^0 --> ΔY^0), and utilize the present monetary discipline measure [i.e., $(-\Delta M^0 * 100)(Y/M)$]. Nevertheless, we do not expect that the effects of the monetary discipline are entirely independent of the resolve Reagan and Thatcher provided. Reagan's firing of the air traffic controllers in 1981, and Thatcher's confrontations with the coal miners, must have helped by reinforcing the monetary policy in bringing about the price and wage changes we point to.

We ask, following the introduction of the presence of episodic change, "What is the information contained in a time series?" In answer, we expect some of it to be purely non-repetitive, as where NOW accounts were included in the money stock measure $M1 in the early 1980s (Frazer 1988,665-687); some of it may represent changes in business conditions (where income, Y, varies about a more permanent income measure, Y_p); and some of time series component may be permanent (e.g., Y_p). We have chosen to analyze data for the decades of 1970s and 1980s, where we see the main difference between the decades as being of an episodic nature. To be sure, we see these two decades, which we presently juxtapose, as being sufficiently differentiated in terms of outside forces that they provide the prospect for significant differences in the time series drawn from the respective decades.

So there are two major features of the work at hand: (1) the testing of the hypotheses themselves (sect. 1.1.2) and (2) study bearing on the content of information contained in the time series data. Indeed, there is in the latter case the twofold matter (a) of a given series (say, Y) containing several classes of information and (b) that of obtaining information from essentially different universes. It is this emphasis on outside forces as dominant ones in both instances, (a) and (b), that is at odds with the fashion in econometric practice which F/S pointed to. The presence of the outside forces in the 1970s and 1980s leads to a rejection of the

"prevailing fashion in econometric work" for use in dealing with the class of economic-policy problem with which we are concern. As pointed out, an underlying theme of the 1980s goes back to J.M. Keynes of the 1920s, notably that wages are sticky and fail to adjust. The 1980s counterpart to this is that wages adjust differently in an era of monetary accommodation vis-a-via one of monetary discipline (Frazer 1988, 649, 668-670). In the 1970s we have what Frazer calls the Keynesian era (monetary accommodation and all as imposed via government) and in the 1980s we have monetary discipline to a reasonably significant extent (Frazer 1988, 649-670).

1.2.1 Monetary Policy

As we have already indicated, monetary policy in the 1970s is very Keynesian-oriented in that monetary policy is accommodative of fiscal policy (defined as a deficit), inflation, and wage increases. To the extent that inflation arises in the Keynesian/Post-Keynesian analytical system it is viewed as a market-structures problem -- oligopoly, administrated prices. Further, power theories of inflation generally enter (Frazer 1988, 208-209, 229, 545-546). Parallel to this market-structures view of inflation, the control of inflation is sought, through price controls where efforts are made to select for the purpose of control firms which "administer prices."

In the 1980s, the market-structures/price-control approach was dropped, monetary policy was viewed as the

principal means of controlling inflation. Money and credit aggregates gained ascendancy as a focal point for controlling and taming inflation. Even as this approach came to be adopt, however, there were special analytical and operational problems at the respective central banks involved in the policy execution. These center primarily about the following: (1) difficulties in targeting a principal monetary aggregate, $M1, when new classes of deposit liabilities at the commercial banks get included in the principal aggregate $M1 (Frazer 1988,655-657); (2) difficulties encountered with the actual execution of policy because of inadequate accounting control arrangements, or because of past practices and traditions at the operations level[4]; and (3) the dramatic change, in the U.K. case, where the U.K. undertook the privatization of previously government owned enterprises in the second half of the 1980s. As the 1980s closed (Frazer

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[4] In his 1991b monograph (sect. 1.2), Frazer offers a principal hypothesis, namely:

> Traditions, operating procedures, and accounting controls influence the choice of economic theory on which government bases its central banking and financial markets policies. (Notes: Sharing the determinants of the money demand function and the workings and economic laws as reported in F/S's Monetary Trend are one thing. The choice of a theory on which to implement policy is another. It may have not only political overtones but dependence on accounting arrangements, for accounting control purposes, and on past practices and traditions.)(1991b, 6).

1991b, chap.4), the public in the U.K. had acquired enormous amounts of liquid assets in the form of marketable shares in the enterprises, and this group ran up considerable debt as the public appeared to dissave in current income terms and the government became a net saver in such terms (i.e., the government ran a surplus in its budget and retired outstanding debt).

All of this complicates the analysis of the demand for money and the execution of monetary policy, the attainment of targets for reserves, the money stock and bank credit in a refined sense. Even so, for the present purpose these complications may be filtered out of the data by focusing on Milton Friedman's uses of statistical methods, and the general trend of monetary policy in the respective decades.

As indicated, the overall role for monetary policy was different for the respective decades in both the U.S. and the U.K.. There is what Frazer has called the "i-regime" and the "M-regime" (Frazer 1991b, sect. 2.3, 2.4 and 2.5).[5] And

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[5] The respective regimes have many dimensions, and have been extensively written about (Frazer 1988). In brief, the "i-regime" label encompasses a traditional banking and Keynesian view which harks back to the days when central banks' sole means of intervening in the money and credits markets was through the discount rate. "The interest rate" is also at the center of policy in the analytical constructs passed along by the Keynesians. This remains true even when we recognize that Britain's J. M. Keynes of 1930s prominence showed special interest in the discovery of open market operations at the Federal reserve Bank of New York.

The M-regime contains interpretations and analyses which substitute for the "i-regime" interpretations and

although a full M-regime orientation may not have been feasible in the U.K. for reasons given by Frazer, we may nevertheless view monetary policy as actually pursued in terms of the principal monetary aggregates (M1 in the U.S., and M3 in the U.K.). This is essentially what Milton Friedman did in the Monetary History (1963) and Monetary Trends (1982) volumes with Anna Schwartz. In other words, irrespective of whether the central banks attempted to report monetary (or money and credit)policy in interest rate or money-aggregate terms, the measure Friedman used was the money aggregate (its time rate of change). This followed essentially from his monetary theory and his total analytical system.

1.2.2 The Policy Approaches, 1970s and 1980s

Establishing the extreme differences in the policy approaches to the two decades was a task Frazer undertook in his Power and Ideas (1988, chaps. 8, 14, 15 and 16). At approximately the turn between the two decades, a reverse set of policies enter in both the U.S. and the U.K. under Ronald Reagan and Margaret Thatcher, respectively. The policies for

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analyses. Stated this way, we associated it mainly with Friedman's monetarism, and no other views of monetarism. This view is strongly rooted in a U.S. tradition of central banking, where OMO's of a special sort play a main role and where the means of accounting for the money and credit aggregates are fairly straight forward (Frazer 1991b, sect. 2.4). This statement is thought to apply despite two developments: (1) the extension of F/S's work to include the U.K. and financial interrelationships between the U.K. and the U.S.; and (2) despite reliance by different countries, and particularly the U.K. and the U.S., on monetarists ideas to tame the almost worldwide inflation of the 1970s.

the most part were to contain and tame inflation by monetary means; to free up the private sector by changing tax structures along incentivist, minimum-government-interference lines; and to eliminate and avoid direct price controls. We see the respective sets of policy--symbolized by the monetary accommodation in the first instance and discipline (inflation taming) in the second--as mainly occurring from outside of the time series and as being imposed on them. Said differently, we see the monetary role as a primary one shaping the time series more generally, and consequently, we proceed very much with what may be called a Friedman/Frazer approach to the analysis of the time series.

The money and credit aggregates approach is quite compatible with F/S's approach in Monetary Trends, and the hypotheses stated about (sect. 1.1.2).

1.2.3 Some Qualifications

Frazer has pointed to some qualifications. Most notably, the monetary policy we indicate and define may be inadvertent on the part of officials in some respects in the 1970s in both the U.S. and the U.K.. To be sure, the interest rate was viewed as the principal control variable on the part of those at the U.K. Treasury and at the Bank of England, even as the reporting of policy in money and credit aggregate terms was debated and imposed on the central banking authorities. At the end of the first decade and the beginning of the second,

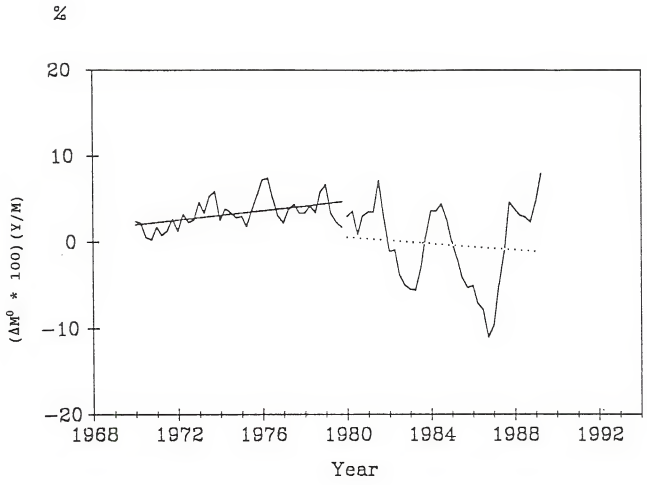

Figure 1-1a Trend Line of the Indicator of Monetary Policy, United States

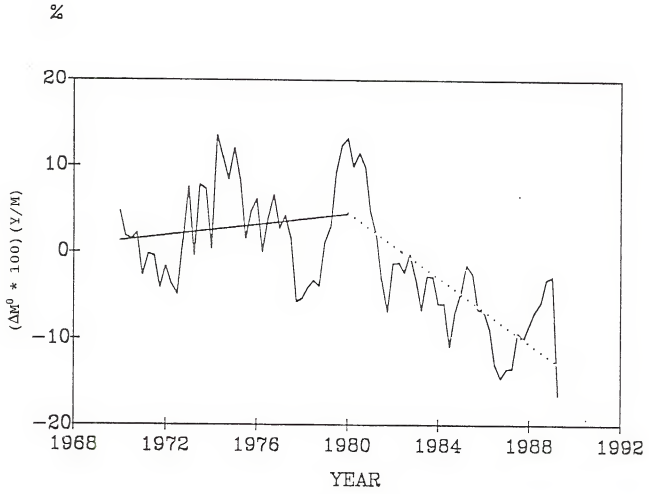

Figure 1-1b Trend Line of the Indicator of Monetary Policy, United Kingdom

a reverse in policy came to both the U.S. and the U.K., but there were problems of implementation, such that old ideas about interest rates and central banking never fully disappeared from the center of policy considerations.

These Frazer has treated as distinct i-regime and M-regime approaches. He has also noted that the Bank of England in particular was not able to fully move along M-regime lines at the policy level for several reasons. For one, accounting control and market intervention practice and traditions were inadequate for the task,[6] and for another, monetary and treasury officials in the U.K. had only a very Keynesian/i-regime view of Friedman's monetarism, even as they attempted desperately in the first half of the 1980s to target the money aggregate sterling M3. Missing targets and losing public confidence, they reverted to i-regime notions and press reporting along such lines, even as they followed fairly disciplinary policies.

Viewed overall for the respective decades for both the U.S. and the U.K., we illustrate the distinct differences in figures 1-1a and 1-1b. There we see the trend of the monetary indicator for the 1970s (actually 1970:I to 1979:IV), the trend for the 1980s (1980:I to 1989:II), and the turn from one period to the other for the United States and United Kingdom, respectively. We see both in the U.S. and the U. K. that the trend line for the monetary indicator has a positive slope in

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[6] See note 4 above.

the 1970s. We call it monetary accommodation. Moving into the 1980s, as shown in both figures 1-1a and 1-1b, the trend line for the monetary indicator takes on a negative slope. We call it monetary discipline. We do not attempt to enter into these matters here, except to point to them and note the indicator of accommodation and discipline, irregardless of policy intentions on the part of the banking officials.

1.3 The Selected Time Series.

The principal time series we select for analysis cover the 1970s and 1980s decades. The series include those for the money stock (M1 in the U.S., and M3 in the U.K.), price indexes, wage rates and productivity. Attention is given to the 1970s and 1980s principally because of the roughly equal time periods and because each decade is characterized by a very different approach to policy. Not only do we have the broad Keynesian and monetarist difference, but we have the difference between monetary policy defined in terms of the principal monetary aggregates for the respective countries during the 1970s and the 1980s decades (Frazer 1988, 648-651, 669-672).

1.3.1 Money Demand

Following Friedman's use of methods and taking note of his "primal equation,"[7]

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[7] Drawing on work undertaken with Kim Sawyer (Frazer 1984) Frazer defines "primal equation" as follows:

> A primal equation is one which can be estimated separately from the other equations.

$$M/P = f(Y/P, w; \ldots; u) \qquad (1.1)$$

Here M is the money stock, P is a price index, Y is income, w is a measure for liquidity in relation to wealth, the dots represent four expected rates of return, and u is a "catch all" variables for secondary influences. Of present significance, the terms M/P and Y/P yield the Cambridge k (or the inverse of income velocity), namely,

$$M = kY, \text{ or } k = M/Y \qquad (1.2)$$

where k is the demand for money ($k = 1/V$, $V = Y/M$). In treating income velocity as money demand, and the money stock, M, as a control variable, Friedman is proceeding to deal with the "identification problem" (Frazer 1988, 543). As Frazer pointed out, his approach to this is also different from that found in the " fashionable econometric method." The demand for money (i.e., velocity, V) changes for a variety of reasons, which we avoid restating,[8] but principally we see it in the decades at issue as a response to changes in expected inflation (or deflation). Moreover, the velocity at any given time is a measure of the extent of the impact of monetary acceleration or deceleration, ΔM^0 (or $-\Delta M^0$) on spending. It

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It is predetermined; it is an equation which comes first and from which other relationships in the economy follow (Frazer 1988, 798 n20).

[8] The definition of "money" itself as stated by Keynes and accepted by Friedman is indicative of the range of things that may influence it. For further statement and the definition, see Frazer (1991a, chap. 4).

enters the indicators for monetary accommodation and discipline (sect. 1.1.2).

1.3.2 The Time Frames

The distinctions as to time frame are (1) the very short run (a point of market intervention with much attention to market adjustments in response to events, and policy actions, inactions and pronouncements), (2) the short cycle, and (3) secular trend. Particularly in the latter instances, as we mentioned above, we see Friedman distinguishing between transitory and relatively permanent changes in the time series. For income (or GNP) these main components of the time series may be denoted $Y-Y_p$, and Y_p, where the transitory component is the difference between the actual data for income and a trend component called permanent income (Y_p), and where the permanent component is the trend obtained by a method of phase averaging (appendix B) in reference to phases in the transitory component. In all instances, with respect to the time frames, episodes may enter to give rise to what F/S called "episodic change."

Episodes are events reported in the news, such as illustrated above (sect. 1.2). Quite obviously, episodes are outside of the usual economic model and indeed offer the prospect of affecting the economic system. There is no problem in saying that they are external to the economy's ordinary functioning, and indeed, the issue arises most

vividly where Friedman treats monetary policy as exogenous and as impacting on business conditions (say causation $\Delta M \dashrightarrow \Delta Y$).

Statistical and other controversy ensued over this, and reverse causation arguments appeared. All of that is not so much the point, however, as the fact that Friedman treated monetary policy as exogenous, along with a host of other events that may impact on time series of the sort he studied. Uncertainty over the outcomes of the events, episodes, policy action, and all entered along with matters captured by reference to "psychological time" (note 2 above; Frazer 1988, 731; F/S 1982, 568-569, 358).

So Friedman went about the search for a stable relationship (or, more accurately, stable phenomenon), in a world where was impacting on the time series. The idea was to separate out changes that were less permanent, and focus on those that were more permanent after adjusting the time series for the episodic part. Great effort was made on filtering out information in the time series to focus on parts of it, in a world where Friedman did not expect "fashionable" econometric technique to work. In his approach he ended, as Frazer points out, in confronting those components in the time series data that have traditionally interested policy makers--short-run crises; the stabilization of the short cycle; smooth, less disturbed economic growth.

All of the above are present in the methods we adopt and in the approach we take.

1.3.3 The Data

Our basic data are quarterly time series for (a) money stock, (b) gross national product, (c) output per hour of all persons, (d) hourly compensation, and annual time series for (e) the consumer price index, and (f) the GNP deflator. The data for the United State come from National Economic Trends and Monetary Trends, both of which are published by the Federal Reserve Bank of St. Louis. And the data for the United Kingdom come from Long Run of Monetary Data which is produced by the money & banking aggregates group, financial statistics division, Bank of England and Economic Trend which is produced by the Royal Central Statistical Office. And, of course, we have supplemented the basic series in generating new series for analyzing particular problems. Since the present focus upon comparisons between the 1970s and the 1980s, we starts series with 1969 and terminates the series with 1989.

CHAPTER 2
THE CONFLICT OVER USES OF STATISTICAL METHODS

2.1 Introduction

Although it should have been apparent that Milton Friedman was proceeding differently from the econometricians in his uses of statistical methods from the time of his 1957 publication titled A Theory of the Consumption Function, this difference did not appear to be apparent to some economists and econometricians until the publication of Friedman's and Schwartz's Monetary Trends (1982). At that time Charles Goodhart took note of the matter in his review article for the Journal of Economic Literature (1982, 1540-1551). Shortly afterward econometricians David F. Hendry and Neil Ericsson (Hereafter H/E) took up the sordid task of employing "fashionable work of econometrics" to the analysis of U.K. data in a series of papers in which they attacked the F/S position (H/E 1984; 1989; 1990). The H/E effort went through stages as they appeared at various conferences (Frazer 1988, 737), and by July 1989 they produced a copy titled "An Econometric Analysis of U.K. Money Demand in Monetary Trends in The United States and The United Kingdom by Milton Friedman and Anna Schwartz" (H/E 1989). Also, a further paper

analyzing time series for modeling the demand for money in the U.K and the U.S. appeared in 1990 (H/E, 1990).

Indeed, H/E's papers provide an opportunity to further focus on the issues over the uses of methods and to illustrate the alternative they rely upon. The issues in a larger context have appeared under such labels as "big models and small models" in the past (Frazer 1973, chap.14). However, we see the issues as narrowing to three in number, as we proceed with an assessment of the alternatives, particularly as represented by H/E. The principal issues are (1) Friedman's vision of time series, both as it relates to (a) the impact of episodes on the data, and (b) his search for a stable (i.e. repetitive) relation; (2) Friedman's approach to filtering information out of the time series in order to focus on information that interest him in the rearch for a stable relation; and (3) his use of simple method, with attention to the bounds on the true regression coefficient. The third is related to the "Leamer problem" (Frazer 1988, 750).

2.2 Filtering and Episodic Change: Friedman vs H/E

Friedman's uses of statistical methods which were present all along were not the main focus of critics' attention from the early 1950s to the early 1980s. Instead, attention was directed toward the importance of the money stock as a variable. However, this was not so after the Monetary Trends was published, as indicated by Charles Goodhart's article on Monetary Trends (Goodhart 1982). There we encounter Goodhart

commenting on F/S's forms of data adjustment. He objected to the separation of trends and cycles, noted incongruity with econometrics, and said that F/S presented evidence in an idiosyncratic manner. Goodhart then expressed concern about the "adjustments and manipulations imposed by F/S on their raw data before testing. (1982, 1541)" Essentially, he pointed to the use of "phase averaging" on the part of F/S. Yet, F/S said that they proceed "indirectly"; that they examined variables a few at a time with reference to hypotheses generated by the theory; that their approach "yields insight that cannot be obtained from the more sweeping approach (the prevailing fashion in econometric work)" (Frazer 1988, 79; F/S 1982, chap. 2, sect. 6.2, 629).

Such divergence in the uses of methods as reflected in Goodhart's comments and Friedman's uses appeared in fragments of the literature with respect to structural equations methods, and the Cowles Commission at the University of Chicago (Frazer 1988, 68-87). But in 1983 and '84 new charges surfaced against F/S in the study by David Hendry and Neil Ericsson of Oxford University's Institute for Econometrics and Statistics and of Nuffield College. In their series of papers, beginning in 1983 and extending to the most recent paper dated July 1990, they picked upon what Goodhart pointed to--"adjustments and manipulations imposed by F/S on their raw data before testing."

In order to reject F/S's claims, H/E emphasized on two issues--(1) "phase averaging" and (2) velocity as a random walk. In doing so, they went back to the annual raw data, because they regarded the F/S adjustments to the data and the phase averaging as limiting the information in the data analyzed. However, in taking this line of criticism, they neglected giving attention to the reasoning behind F/S's use of phase averaging. Of course, the reasons for "phase averaging" were (1) to aid in fitting a trend and at the same time determine beginning and terminal points for a period, (2) to facilitate the separation of components of information contained in a time series, and (3), as Friedman said later, to highlight "one class of information" and "avoid its being diluted by a class of information relevant to a question we're not trying to answer"[1] (Frazer and Sawyer 1984).

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[1] On the statistical problem of separating the components which in fact concern separate time frames for a relevant economic theory, Friedman said:

> The problem is that a set of data contains information about more than one question, and you want to eliminate information about questions you are not interested in. This is in order to concentrate on information about questions you are interested in ....
>
> Now if I had a perfect cycle, if I had a sine curve, or alternatively, if I had a perfect theory of the cycle, it might be possible to analyze the secular question using all the data but including in the multiple regression its equivalent variables that determine the cycle. But we don't have such a theory. We know certain things. We know that these cycles are irregular in amplitude, they are irregular in timing, we know that we don't have a satisfactory explanation. And given those limitations of our knowledge, we want to suppress the information about the cycle.
>
> I wouldn't call it throwing away [information]. I

2.2.1 Phase Averaging

In illustrating the technique of phase averaging, we follow standard F/S procedure and draw on NBER reference cycle dates. Via this route, the phase average is computed as a weighted average of all observation during a phase, an average (or point) is obtained, and the procedure is repeated for another phase. This is such that we get initial and terminal points which demark a period for which a trend line may be filtered.

In phase averaging, initial and terminal points are weighted one-half and intervening observations given a weight of unity, as illustrated in appendix B. This procedure constitutes imposing a prior belief on the data, which came about from the use of the NBER chronology for the United States and Economic Trends and Employment Gazette chronology for the United Kingdom. The phase averaging helps in fitting trend lines and thereby in separating the phenomena we wish to investigate. It is also technically regarded as filtering (Frazer 1988, 756; Jazwinski 1970).

In phase averaging and fitting trend lines, we separate the components of information contained in a time series, and as Friedman said, we highlight "one class of information" and "avoid its being diluted by a class of information relevant to

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would call it, rather... highlighting one class of information and trying to avoid its being diluted by a class of information relevant to a equation we're not trying to answer. (Frazer and Sawyer 1984)

a question we're not trying to answer" (Frazer and Sawyer 1984). Indeed, the purpose of "phase averaging" is twofold--to aid in the selection of the beginning and terminal points for a period and to aid in fitting the trend line and filtering out irrelevant information and keeping the more permanent components. We may illustrate this use of a trend line by refering back to figures 1-1a and 1-1b. Further, in refering back to chapter 1 (sect. 1.2) we see the periods themselves as episodes (i.e., periods charaterized by different political/econoimic orientations).

Also, F/S saw structural change--i.e., change in the structure underlying formation of inflationary expectations. And an episode entered-- i.e., the great peace-time inflation with monetary accommodation of wages, government spending, and prices. In addition, Frazer treated the turn in policy which he referred to as "The Big U-Turn." With that change we have the monetarism that Thatcher and Reagan implemented in the 1980s. So with these two episodes we have the trend in the monetary indicator for the 1970s, and the trend for the 1980s and the turn from one period to the other for the United States and United Kingdom, respectively. We see all this in data results for both in the U.S. and the U. K., which we point to in figures 1-1a and 1-1b. The trend lines in the figures are compatible with the economic/political orientation we offer. They were obtained by the statistical method we review in appendix C.

2.2.2 The Filtering of Trend Lines

There are several methods for filtering trend lines, (1) the method F/S used; (2) fitting by a use of the simple loglinear regression, and using beginning and terminal points for a period such as may be obtained by the use of reference cycle dates; (3) the equal-length subsample method. In actually obtaining trend lines in this present work, we use a combination of the first and second methods, and H/E use the third method. The results for both the U.S. and the U.K. sets of data are reported in appendix C. The data we analyze are the differences between the growth in wages and the growth in productivity and the indicator of monetary policy both for the U.S. and the U.K. The tests employed in finding the best fit are two primary tests in an analysis of covariance. That will test which model is the best fit (Frazer 1973, sect. 2A3).

The first of the primary test is a test of the hypothesis of no interaction. In a regression context, where we treat the categorical variables as control variables, the null hypothesis of no interaction corresponds to the null hypothesis that the N regression lines between Y and X for the N levels of the categorical variables are parallel. If the null hypothesis of no interaction is not rejected, then in further analyses we assume that the N regression lines are parallel.

The next hypothesis that is of interest is that the N regression lines are in fact identical; that is, they have not

only have the same slope, but also the same Y-intercept (see appendix C). The results obtained from illustrating the fit of trend lines will be drawn upon in the following chapters, when we test the hypotheses of section 1.1.2.

2.2.3 H/E's Equal-Length Subsample

In the F/S-H/E controversy, a main question is whether F/S's or H/E's results mean anything in terms of policy. Drawing on one of H/E's latest articles (1990) on the issue of modeling money demand, we find that they have attacked F/S's use of "phase averaging" in the past, even as they themselves engage in data transformations in terms of what they call the "equal-length subsample." In dealing with "equal-length subsample" H/E are taking time series and dividing them into ten approximately equal length subsamples. In introducing them H/E fit trend lines to the ten subsamples which they illustrate and which we reproduce as figures 2-1a and 2-1b. The results they obtain by such an arbitrary division of the time period give rise to their claim that " ... virtually every possible correlation between the growth rates of money and prices can be observed" (H/E 1990, 12). These results offers no positive policy associations, and, at the same time they leave behind questions that we want to raise.

Whereas H/E pointed to "phase averaging" as losing information in the earlier time (H/E 1983, 6), they now use a

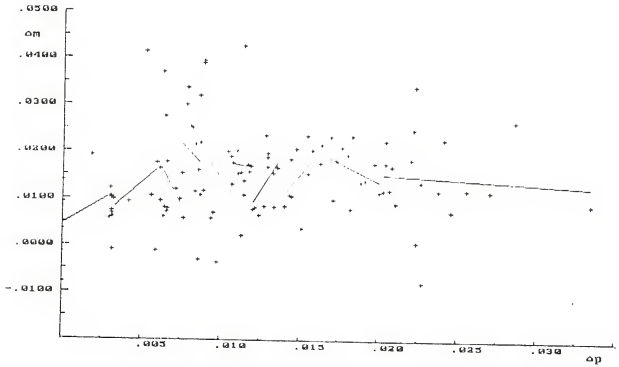

Figure 2-1a H/E's "Equal-Length Subsample" for the Relation between Money Stock and the Price Index for the United States

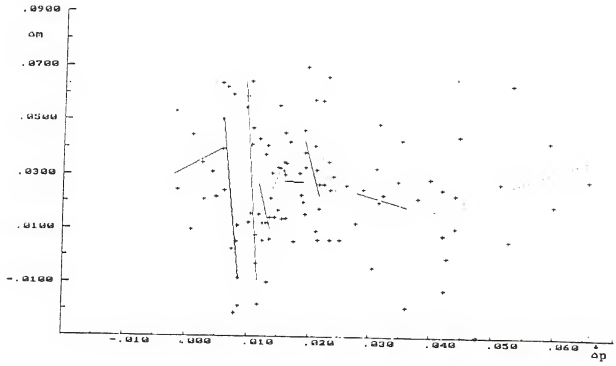

Figure 2-1b H/E's "Equal-Length Subsample" for the Relation between the Money Stock and the Price Index for the United Kingdom

method they refer to as an "equal-length subsample." The difference between this and "phase averaging" is that F/S calculate phase averaging base on the chronology data provided by the National Bureau of Economic Research and H/E pick up their subsamples by focusing upon ambiguous, equally divided subperiods where there is no economic reason for doing so.

Indeed Friedman considered that phase averaging separates relevant information from information which may confound estimation of the parameters. In this sense, Friedman's use of phase averaging is likely to have a more stable relation than for the original, unfiltered data, because the positive serial correlation within a phase is at least partially removed, and because the effects of extreme expansions and contractions are dampened. The reverse of these reasons is what leads H/E to pick up all the irrelevant information to conclude with uncertain results and no positive policy associations.

To summarize, phase averaging may not be the best filter for the entire set of observations. Nonetheless, it is justified as a mechanism for filtering out some episodic and transitory changes and for thereby focusing on a more persistent component of imformation.

2.2.4 H/E and Velocity as a Random Walk

In returning to the subject of velocity as a random walk, Huhne in The Guardian said:

> Professor Hendry likens velocity to the walk home of a drunken man: he's heading roughly in the right

> direction but one can never predict whether his next step will be backwards, forwards or sideways. It is a "random walk" (Huhne 1983)

While econometricans measure stability in terms of random variability of the coefficients, F/S's conception of stability is markedly different from that. For F/S, stability in the velocity of money is stability as a phenomenon but not as a numerical constant which means the explantory power and magnitude of coefficients should not vary greatly across episodes. Rather F/S make inferences about the phenomena and the prospect that a given economic variate must be essentially the same for two or more different economies (Frazer 1988 753-757).

In 1990 H/E contradict what they claimed at the earlier time. More recently they said, "As will be seen, the data for both countries are remarkably similar in many respects,..." (H/E 1990, 11). Here, indeed, the random walk hypothesis is refuted by H/E's words about the close concordance of velocity movements in the U.S. and the U.K. If velocity in each country is indeed a random walk such parallel movements in velocity will surely not be observed. That is one of the reasons F/S introduced the extra dimension by way of the consideration of two countries, rather than one.

2.3 The Multiple Regression Problems

Starting with Lawrence Klein, and following in most econometric textbooks, we find a common emphasis on the following: the determination of the values for the variables

within the models almost entirely; the multivariate regression models; the avoidance of any role for episodic change (except as may appear with the dummy variable), and the assumption of independence on the part of right-hand-side variables in regression equations. Such an approach is symbolized by the developments associated with big models and the Nobel laureates Jan Tinberger and Lawrence Klein. The latter moved from the Keynesian IS-LM model to the Klein/Goldberger model (Theil 1971, sect. 9.8-9.9) to the big models (Frazer 1984; 1991a, sect.12.4).

In summary, the multiple regression problems we point to are contrasted with the key features of Friedman's approach (sect. 2.1):

The Multiple Regression Problems	Features of Friedman's Approach
1. The determination of value for the endogenous variables within the model, with a non-significant role for the episodes.	1. Attention to episodic change, in combination with a search for a stable relation after adjustments and allowences for episodes.
2. The addition of variables (also meaning time series) to the right-hand side of the multiple regression equation in an attempt to account for unexplained variation in a left-hand side variable.	2. Friedman's decomposition of time series with respect to episodic and transitory changes, and the more permanent components.
3. The assumption of independence in the variables on the right-hand side of the multiple regression.	3. Interdependence in the variables (also meaning time series) due in large part to episodic change.

4. The inability to set the bounds on the "true" regression coefficients as variables are added to the right-hand side of the regression equation.	4. Attention to the bounds on regression coefficients for the simple regression model (i.e., also a recognition of the "Leamer problem").

The features within each of the distinct columns are interrelated. As to Friedman's use of statistical methods, with the monetary policy emphasis he provides, Frazer reduces the focus of the statistical work to one of the purpose at hand and the usefulness of the method for that purpose (1991a, sects. 2.4b, 3.2b, and 7.2c). In the monetary policy context, we should treat effects along lines that are useful for those who make and try to understand the monetary policy and effects which comes about in a monetary economy.

On the one hand (the left col. above), there are the efforts to seperate the effects by directing attention along one line for the use of statistical methods, and, on the other (the right col. above), there is virtual recognition that success cannot be attained along the first line (hypothesis 4, sect 1.1.2). To simply illustrate the line where success cannot be attained, we have the following equation,

$$GNP = a_0 + a_1 i + a_2 \$/£ + a_3 P^e + a_4(\text{funding policy}) + \ldots \quad (2.1)$$

where GNP is gross national product, $/£ is the price of the pound (£) expressed in U.S. dollars, i is the rate of interest (symbolic of a vector of many rates), "funding policy" is the Bank of England's policy with respect to the government's borrowing requirement and "..." signify omitted

variables. Now, the separation of effects problem is that of thought and discourse where both proceed with the view that the effect of right-hand side variable (say, i) on the left-hand side variable (GNP) is separate from all the other variables on the right-hand side of the equation (say, $/L, P^e, funding policy and so on), when in fact the effects of the right-hand side variables may be inseparable and indeed even appear as a package of interdependent variables. For example, inflation may be due to the government's "funding policy" (or monetary accommodation of the government's financing) and at the same time inflation may lead agents in the financial markets to trade bonds at lower prices (higher interest rates) and pounds at lower prices (lower exchange rates).

The common, artificial means of proceeding is that of "forcefully" locking up all other things explicitly or by implication. The phrase " all other things" (ceteris paribus and presumed independence, and so on) may be invoked explicitly, but most likely the presumption of independence will be present only by implication.

Friedman recognized this separation of effects problem in the analysis of actual data and sought to deal with it by proceeding with what we have referred to as an alternative and called the "indirect method" (Frazer 1988, 542).

Starting with Walras, economists over the years added features to the mathematical problem of having a solution to an equation system when the number of variables equaled the

number of non-redundant equations. For one, the solution equations came to be called reduced forms; for another, a special class of parameters called exogenous variables were added; and for still another, distributed lag relations were added, such as we have given attention to on one occasion or another. The variables determined by the structural equations models were said to be endogenous as taken up in appendix A. The exogenous variables could be controlled, as by an outside authority such as the Federal Reserve or the legislative and executive branches of government. But the point was that for the most part the parameters attached to the endogenous variables of the model would be stable over time.

In statistical parlance, if the parameters had been estimated for one period, then they will remain unchanged when estimated for another sample period.[2] Unstable parameters, as we are to see in the later chapters, mean that some relevant real world forces were excluded from the regression equation. Where the estimated values for parameters were not stable and where the values for the error term are correlated with the variables within the model, the idea in terms of structural equation model thinking is to add more variables and equations to account for the instability. The general

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[2] The sample period is the period over which data are analyzed in the sense that they are used to estimate parameters of a model. The model is presumed to apply beyond the sample period in the classical, relative frequency approach to probability. The parameters are presumed to be stable in this approach.

idea, in other words, is to include all endogenous variables in the model.

The problem arose in this approach that there was no end to the number of variables and equations one could add (Frazer 1973, chap. 14; 1984, 51-53). We see Keynesian economics move from a two-equation IS-LM model, to a Federal Reserve-MIT model of the mid to late 1960s of from 65 to over 150 equations. By the early 1980s, Lawrence Klein had a model with over 1000 equations and links to models for other countries (Klein 1983). Still there was no adequate stability in the parameters that made them of any use for the purpose of conducting monetary policy. Said differently, you still have something very much like equation (2.1) above with the idea that right-hand side variables can be controlled independently of one another.

Something was overlooked. On the one hand, it has been suggested that instability had to do with random phenomenon and, on the other hand, it has been suggested that omissions had to do with psychological and socio-economic forces, and with learning, changing expectations, changing political administrations (policy), and so on. In summary, there are two things: (1) there are impacts on the time series (such as whether monetary accommodation or monetary discipline in the U.S. or the privatization of government owned companies in the U.K.) which interfere dramatically with the notion that the inside variables are really determined within the analytical

system; and (2) there is the notion of upper and lower bounds to a true regression coefficient (F/S 1982, 224-226). The latter calls attention to the frailty of the multiple regression technique for analyzing economic time series, where the purpose bears on the separation of the effects posited by economic theory and the use of the equations as a guide to economic policy.

F/S, in their book Monetary Trend (1982), pointed out why they proceeded differently. "We believe," they said, that their indirect approach "yields insights that cannot be obtained from the more sweeping approach (the pre-1982 "fashion in econometric work")" (1982, 211). They believed and said "that multiple correlations of many variables are almost impossible to interpret correctly unless they are backed by more intensive investigations of smaller sets of variables" (1982, 214). F/S's indirect approach then is simple and in contrast to proceeding immediately to compute multiple regressions "including all variables that can reasonably be regarded as relevant" (1982, 214).

The F/S use of simple method consisted of analyzing data for a few variables at a time, before proceeding to the more sweeping use of technique. Along this route, we encounter the idea of a 'true' regression coefficient (F/S 1982, 226) for two variables and the extension of the idea by Edward Leamer to more than two variables (Leamer 1978 and 1985; F/S 1982, 224-225). Starting with two variables from a purely

statistical point of view, there is the problem of all variables being subject to error and the matter of setting upper and lower bounds on the true regression coefficient. Friedman said "that applying an upper and lower limit is really the most effective way to have some idea of knowing what I do know and what I don't know." Leamer in turn replied to a paper entitled "What Will Take The Con Out of Econometrics ?" In this reply he discussed the extreme bounds analysis (EBA) and the properties the bounds depend on (Leamer 1985). Continuing then, we have the Leamer problem, which is as variables are added to the regression equation "it's extremely difficult to set limits on separate regression coefficients ..., and that beyond some points, you may be able to set no bounds on it at all" (Leamer 1985, 313).

CHAPTER 3
THE MONETARY INDICATOR, INFLATION RATES, AND MONEY DEMAND

3.1 Introduction

This chapter centers about hypotheses 1 and 2, which we first stated in section 1.1.2. In the first of the hypotheses we follow F/S in Monetary Trends (1982). There they find that the United Kingdom and the United States have in common the same determinants of the money demand functions (F/S 1982, sect. 5.4). Others such as H/E argue that velocity is a random walk (sect. 2.2.4), yet statistical results indicate that velocity cannot be a random walk. If velocity in each country is indeed a random walk, then the parallel movements that we find in velocity will surely not be observed.

In the second hypothesis we take up the question whether prices and nominal wage rates adjust more readily in the presence of monetary discipline as defined in section 1.2. We recall that Keynes pointed to "sticky wage" as a behavioral matter in the 1920s and based the General Theory on the notion of a wage standard as reviewed by Hicks (1983)--i.e., that wages would remain "sticky" and hence vary only in relation to productivity, as total spending was managed to achieve Keynesian full employment.

Hypothesis 2 gains its importance for having been introduced by J. M. Keynes in the 1920s, in the form of the

issue of sticky prices and the special price called "the wage rate." As built into Keynes's General Theory (1936) and as introduced in section 1.1.2, wages failed to adjust downward in the presence of unemployment, there was a failed view of monetary policy, and fiscal policy enters.

As reviewed by Frazer (1988, chap. 16; 1991b), Friedman offers a substitute view to that of interest rates and monetary policy, and it was taken up by Ronald Reagan in the United States as a part of what was called "supply-side economics." The idea was to use monetary policy to tame inflation and hence in general bring about a downward adjustment in the inflation rate which had gotten built into pricing policy and wage contracts in the 1970s. In the United Kingdom Margaret Thatcher also adopted Friedman's "monetarism" (so called in London) and took up the issue of wage adjustments as a part of the taming of inflation by monetary means. Via this route we link up the economics and the political positions and point to what we have defined in sections 1.1.1 and 1.2 as monetary discipline.

In the context of the foregoing analysis, an empirical question arises. That is whether the inflation is caused by non-monetary forces (power theories of inflation) or by monetary forces (accelerated money growth).[1]

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[1] Power theories of inflation center about the economic theories of market structures (Frazer 1991a, sect. 2.2e and 2.2g). Early on Friedman tended to reject them (Frazer 1988, 306-323).

3.2 The Monetary Indicator, Money Demand: an Episodic View

In returning to hypothesis 1 (sect. 1.1.2), figures 1-1a, 1-1b, may be referred to again as well as the fitting procedure we take up in appendix C. We recalled that the figures showed the trend in monetary policy for the 1970s (actually 1970:I to 1979:IV), the 1980s (1980:I to 1989:II), and the turn from one period to the other for the United States and United Kingdom respectively. To indicate the periods and the turn, we use the indicator provided by the product of the change in policy [$\Delta(1/M)(dM/dt)$] and the velocity ratio (Y/M). The velocity ratio enters as a factor on two grounds: (1) because it is a measure of the impact of the policy change on total spending, and (2) because monetary officials should be expected to take the secular shifts in the velocity ratio into account in judging the impact of the policy they pursue.

In reference to the trend lines (figures 1-1a and 1-1b) the equations we obtained are as follows:

$$\bar{M} = 2.440101 + 0.2772t \quad (\text{during 1970s})$$
$$(8.456)^* \quad (2.9785)^*$$

$$\bar{M} = 2.558236 - 0.1794t \quad (\text{during 1980s})$$
$$(9.225)^* \quad (-2.6246)^*$$

for the United States, and

$$\bar{M} = 1.599123 + 0.1776t \quad (\text{during 1970s})$$
$$(4.1175)^* \quad (2.6016)^*$$

$$\bar{M} = 22.53880 - 1.8899t \quad (\text{during 1980s})$$
$$(8.9241)^{*} \quad (-4.5112)^{*}$$

for the United Kingdom. In these equations, t is time, $\bar{M}$ is the indicator of monetary policy (expressed as percentage point), the asterisk means coefficients are significantly different from zero at 5% level of significance.

Comparing the equations and the related results for the 1970s with those for the 1980s, we see a significant difference between the two decades with respect to the indicators of monetary policy. During the 1970s the trend was upward in the U.S. by almost 0.27 percent per annum. Yet, turning into the 1980s the trend was downward by almost 0.18 percent per annum. In the United Kingdom, during the 1970s the trend was upward by almost 0.18 percent per annum. Yet, turning into the 1980s the trend was downward almost 1.9 percent per annum.

Upon comparisons, two major points are possible. First, the trend lines for the United States and the United Kingdom reveal a significant difference between the two decades. Second, both U.S. and U.K. trend lines are moving upward in the 1970s and downward in the 1980s. With the governments adopting a full employment goal, without a major regard for the inflationary consequences of monetary policy, they accommodated other developments such as wage price increases. Under monetary discipline, such as we find for the 1980s for the most part, the wage and inflation rates may be expected to

adjust downward to achieve employment up to the natural rate (i.e., to achieve the noninflationay rate of unemployment).

Returning to the hypotheses, the trends we reported for the monetary policy are found in both the U.S. and the U.K. Said differently, the respective countries shared common monetary policies. The results from the analyses of data for the 1970s and 1980s decades support F/S's claim in Monetary Trends (1982, sect. 5.4).

Also, with respect to the results and the distinction we make between the 1970s as an episode and the 1980s as an episode (sect. 1.2), we see a case for the importance of the episodic approach to data analysis. Certainly the case seems meaningful by comparison with H/E's case of the equal-length subsample (sect. 2.2.3). Also from these results we see that the series change direction from one episode to another episode.

The further implication of the results is that the same causal, exogenous forces affected the series in the two countries, namely, monetary policy. So, in addition to examine the indicator of monetary policy, we move one more step to see whether the series for money demand exhibit similar results, as suggested by F/S's Monetary Trends (1982, sect. 5.4) and hypothesis 1 (sect. 1.1.2).

Fitting trend lines for various income velocity ratios, we obtain the following results, shown as figure 3-1a and figure 3-1b:

$$V1 = 4.490945 + 0.199708t \quad (\text{during 1970s})$$
$$(126.517)^{*} \quad (35.121)^{*}$$
$$V1 = 8.193847 - 0.097976t \quad (\text{during 1980s})$$
$$(35.677)^{*} \quad (-6.767)^{*}$$

for the United States, and

$$V1 = 5.249726 + 0.166599t \quad (\text{during 1970s})$$
$$(52.765)^{*} \quad (9.486)^{*}$$
$$V3 = 5.394873 + 0.153929t \quad (\text{during 1970s})$$
$$(27.962)^{*} \quad (4.526)^{*}$$
$$V1 = 11.94126 - 0.390892t \quad (\text{during 1980s})$$
$$(42.160)^{*} \quad (-20.535)^{*}$$
$$V3 = 10.363697 - 0.308630t \quad (\text{during 1980s})$$
$$(42.160)^{*} \quad (-20.535)^{*}$$

for the United Kingdom. In these equations, t is time, V1 is the velocity ratio for dollars M1 or pounds M1 as the case may be, V3 is for pounds sterling M3 in the United Kingdom. And the asterick means that the coefficients are significantly different from zero at 5 percent level. In these statistical results we again see a significant difference between the orientations of the 1970s and the 1980s respectively. In the case of U.S., during the 1970s the trend was upward by almost 0.2 every year as both shown in the statistical results and as illustrated in figure 3-1a. Yet, turning into the 1980s the trend moved downward by almost 0.1 every year as was also shown and illustrated. Roughly paralleling these results for

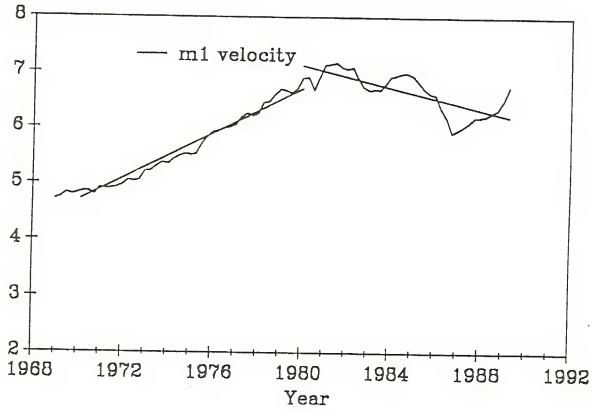

Figure 3-1a Money Demand in the U.S. during the 1970s and 1980s Respectively

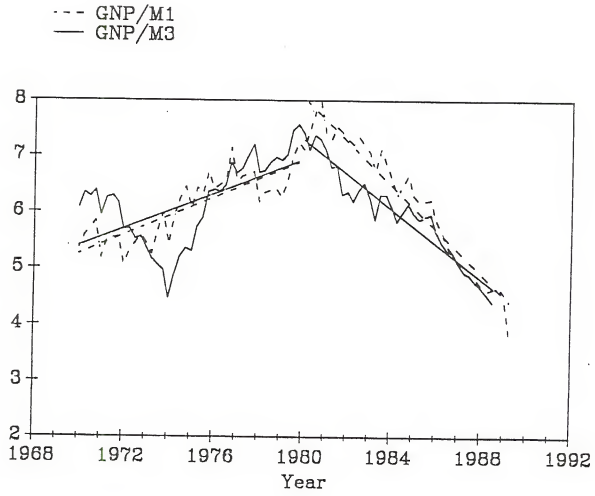

Figure 3-1b Money Demand in the U.K. during the 1970s and 1980s Respectively

the U.S. and illustrated in the figure 3-1b the trend in the U.K. was upward by almost 0.15 every year during the 1970s both in the series V1 and series V3. Yet, turning into the 1980s the trend moved downward by almost 0.3 every year for series V3 and 0.4 for series V1.

These foregoing results again show that both for the U.S. and the U.K. the series moved in the same direction in the respective decades. Consequently, the results show further support for the prospect that income velocity is not moving as a random walk. If money demand did behave as a random walk, then parallel movements in the series of income velocity would not be found.

Making the two-country comparisons introduced by F/S (1982), we see not only parallel movements the U.S. and the U.K. series but a shared change of direction from the 1970s as an episode to the 1980s as an episode. The implication is that the same causal forces affected the series in the two countries.

The analysis we presented with above and the results we found are supportive of hypothesis 1 (sect. 1.1.2). The two countries are experiencing similar monetary phenomena.

3.3 Prices, Nominal Wage Rates and Monetary Discipline

Returning to hypothesis 2 (sect. 1.1.2), we recall that Keynes did two things which are of present interest, namely, (1) Keynes pointed to "sticky prices" (and the wages underlying them) in the 1920s, and (2) he based the General

Theory on the notion of a wage standard (Hicks 1974; 1984). The first of these notions is the one primarily addressed by hypothesis 2, and the second is closely related. In the first case, we simply compare the inflation rate adjustment for the 1970s and 1980s respectively, where in the first decade we have monetary accommodation and in the second decade we have monetary discipline. We expect, in contrast to the "sticky prices" view, that the inflation rate will adjust downward in the 1980s, in both the U.S. and the U.K., plus we expect greater adjustment in the U.K. than in the U.S., principally because the discipline was greater in the U.K. (figures 1-1a and 1-1b).

The second notion above--that of the wage standard--further implies that wages will not rise greater than productivity (i.e., that wages and productivity bear a constant and unchanging relation to one another that neither is altered by inflation or deflation) in the presence of demand management to assure full employment. The second notion then is also related to the first to the extent that the use of monetary policy (or demand management policy generally) should have no bearing on the inflation rate either in terms of the price indexes or the relation between nominal wages and productivity.

To test hypothesis 2 we presently do two main things: (1) follow Friedman and examine relations between trends in the data series, and (2) split the overall sample period into two

sub-sample periods. In the latter case, we also follow the view that monetary policy is very different in the respective sub-sample periods. Although we look at the secular trend data and the policy differences in the two decades, there is the prospect, from the policy point of view, that inflation rates and nominal wage rates in relation to productivity respond differently to monetary accommodation, on the one hand, and discipline, on the other. We take this to mean that monetary discipline facilitates price and wage adjustments.

The reliance on the trends in the data series, as we pointed out initially (sect. 2.2) is simply a way of filtering out of the time series some of the troublesome, episodically imposed information we do not wish to confront. The data-method we employed in this regard may be readily contrasted with that used by H/E (sect. 2.2.2).

In proceeding we obtained results of two types. First, we juxtapose trends in the series for inflation rates, nominal wage rate and the indicator of monetary policy for the respective decades. Second, we examine means and standard deviations for the inflation rate and the indicator of monetary policy measures for the respective decades. The differences between our analysis and that advocated by H/E are twofold, that we give emphasis to knowing something about the policy experiments that generated the data (as opposed to say arbitrarily selecting the sample period) in the choice of the sample periods; and that we readily admit to sampling from

different universes where H/E do not. In the one instance, the emphasis comes from an exogenous, policy view of time series. In the other, the emphasis comes from the "the prevailing fashion in econometric work" where we encounter the prospect sampling from the same universe.

3.4 Statistical Results

In this section we present the statistical results for hypothesis 2. In the testing, we first look at trends (figures 1-1a, 1-1b, 3-2a and 3-2b) and related results. We next look at the averages for the split sample period (figures 3-4a and 3-4b) and the related results.

3.4.1 The Trend Analysis

The earlier figures 1-1a and 1-1b may be referred to along with the present figures 3-2a and 3-2b. Where we show trend lines for the inflation rates for the United States and the United Kingdom, respectively. The equations defining these trend lines are as follows:

$$P_{CPI} = 4.347273 + 0.780606t \quad \text{(during 1970s)}$$
$$(3.039)^{*} \quad (2.914)^{*}$$

$$P_{GNP} = 5.976364 + 0.316364t \quad \text{(during 1970s)}$$
$$(6.967)^{*} \quad (2.699)^{*}$$

$$P_{CPI} = 10.845968 - 0.437903t \quad \text{(during 1980s)}$$
$$(2.889)^{*} \quad (-2.607)^{*}$$

$$P_{GNP} = 11.548065 - 0.504194t \quad \text{(during 1980s)}$$
$$(3.639)^{*} \quad (-2.285)^{*}$$

for the United States, and

P_{CPI} = 10.874545 + 0.647879t (during 1970s)

(3.473)* (2.104)*

P_{GNP} = 8.930909 + 0.870909t (during 1970s)

(3.162)* (2.386)*

P_{CPI} =12.043387 - 0.410161t (during 1980s)

(2.684)* (-2.314)*

P_{GNP} =24.115484 - 1.166452t (during 1980s)

(3.639)* (-2.485)*

for the United Kingdom. In these equations, t is time, P_{CPI} is the inflation rate CPI, P_{GNP} is the inflation rate measured by the GNP deflator. The asterisk means the coefficients are significantly different from zero at 5% level.

In response to the accommodative monetary policy in the 1970s, we observe positive slope for the trend lines of the inflation rates both in the United States and the United Kingdom. Also, for the 1980s era of monetary discipline, all the trend lines for the inflation rate series take on negative slopes not only for the United States data but also for the United Kingdom data.

The above results indicate very positive support for hypothesis 2--prices adjust more readily in the presence of monetary discipline. Indeed, inflation rates readily adjust downward in the presence of monetary discipline both the U.S and the U.K..

Taking up the same procedure as that used above, and extending its use to the nominal wage rates for both the U.S.

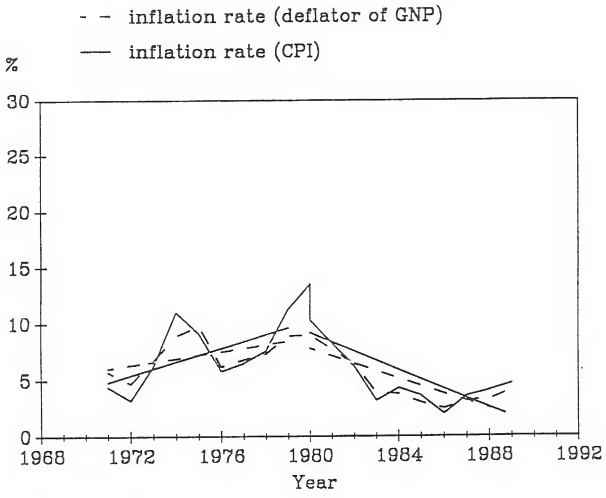

Figure 3-2a Trend Lines for Inflation Rates, United States

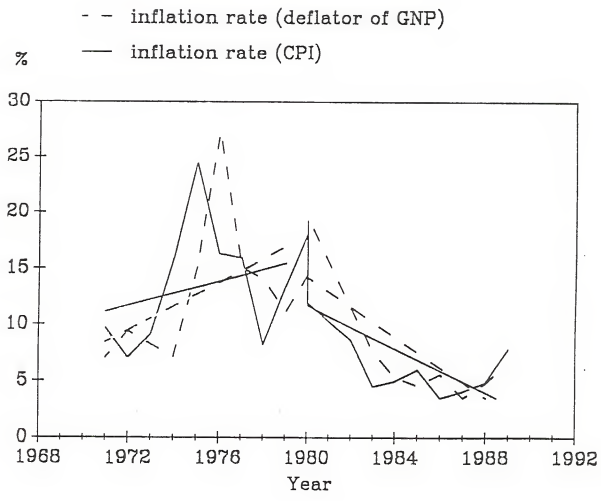

Figure 3-2b Trend Lines for Inflation Rates, United Kingdom

and the U.K., we obtain the following trend lines:

$$w = 1.7064 + 0.0613t \quad \text{(during 1970s)}$$
$$(5.212)^{*} \quad (3.909)^{*}$$

$$w = 3.8640 - 0.1670t \quad \text{(during 1980s)}$$
$$(7.342)^{*} \quad (-7.227)^{*}$$

for the United States, and

$$w = 3.1917 + 0.0745t \quad \text{(during 1970s)}$$
$$(4.572)^{*} \quad (1.134)$$

$$w = 5.3887 - 0.1974t \quad \text{(during 1980s)}$$
$$(9.381)^{*} \quad (-5.167)^{*}$$

for the United Kingdom. In these equations, t is time, w is the nominal wage rate (hourly compensation). The asterisk means the coefficients are significantly different from zero at 5% level. The results are illustrated graphically in figures 3-3a and 3-3b.

Again, viewing the results overall, they indicate stong positive support for the wage part of hypothesis 2--nominal wage rates adjust more readily in the presence of monetary discipline. In response to the accommodative monetary policy in the 1970s, we observed positive slopes for the trend lines for nominal wage rates both in the United States and the United Kingdom, and we also observe that during the monetary discipline era of the 1980s. All trend lines for the series of nominal wage rates take on negative slopes for both the United States and in the United Kingdom.

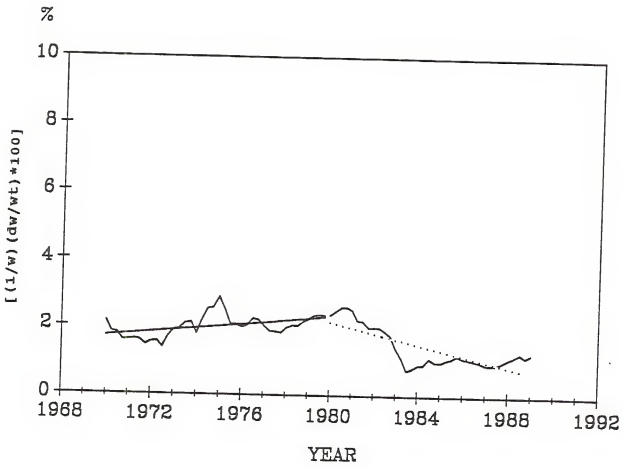

Figure 3-3a Trend Line for the Nominal Wage Rate, United States

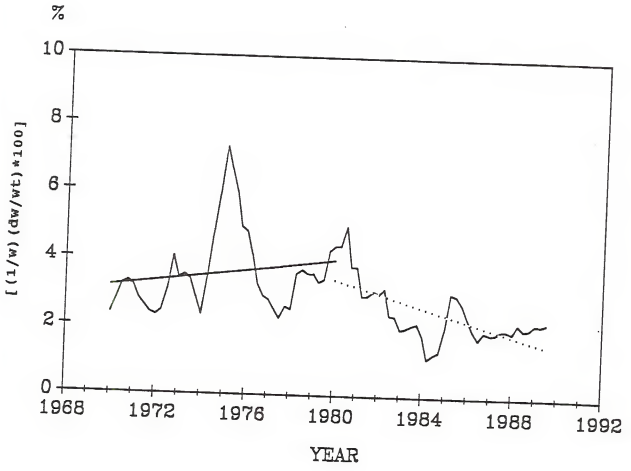

Figure 3-3b Trend Line for the Nominal Wage Rate, United Kingdom

This found shows nominal wage rates adjust readily in the presence of monetary discipline. In addition, the nominal wage rates for both the U.S and the U.K. reflect to the change in monetary policy as we move from the decade of the 1970s to that of the 1980s.

In order to be reassured of the relationships between the prices, the nominal wage rates, and the monetary policy, we move one step further to examine relations between the predicted inflation rates and the predicted indicator of monetary policy. In doing this we obtain the following equations:

$$P_{CPI}^{e} = 15.36301 + 2.816039\tilde{M}^{e} \quad \text{(during 1970s)}$$
$$(13.55)^{*} \quad (3.994)^{*} \qquad R^2 = 0.98$$

$$P_{GNP}^{e} = 6.268468 + 1.141284\tilde{M}^{e} \quad \text{(during 1970s)}$$
$$(18.67)^{*} \quad (4.599)^{*} \qquad R^2 = 0.99$$

$$P_{CPI}^{e} = -8.57694 + 2.440931\tilde{M}^{e} \quad \text{(during 1980s)}$$
$$(-39.6)^{*} \quad (15.94)^{*} \qquad R^2 = 0.99$$

$$P_{GNP}^{e} = -9.88474 + 2.810446\tilde{M}^{e} \quad \text{(during 1980s)}$$
$$(-39.9)^{*} \quad (16.56)^{*} \qquad R^2 = 0.99$$

for the United States, and

$$P_{CPI}^{e} = 5.041080 + 3.647967\tilde{M}^{e} \quad \text{(during 1970s)}$$
$$(6.84)^{*} \quad (7.554)^{*} \qquad R^2 = 0.99$$

$$P_{GNP}^{e} = 1.089295 + 4.903766\tilde{M}^{e} \quad \text{(during 1970s)}$$
$$(4.237)^{*} \quad (6.321)^{*} \qquad R^2 = 0.99$$

$$P_{CPI}^{e} = 0.653348 + 2.170278\tilde{M}^{e} \quad \text{(during 1980s)}$$
$$(3.595)^{*} \quad (5.94)^{*} \qquad R^2 = 0.99$$

$$P_{GNP}^{e} = 0.844593 + 6.172630M^{-e} \text{ (during 1980s)}$$

$$(4.114)^{*} \quad (10.22)^{*} \qquad R^2 = 0.98$$

for the United Kingdom. In these equations, M^{-e} is the predicted indicator of monetary policy, P_{CPI}^{e} is the predicted inflation rate (CPI), P_{GNP}^{e} is the predicted inflation rate (deflator of GNP), and the asterisk means coefficients are significantly different from zero at 1% level. Again, to be sure, the results we have here indicate that the predicted inflation rates (ex post predictions) are highly correlated with the predicted indicators of monetary policy (also ex post) in both the United States and the United Kingdom.

Similar results are obtained for the relations between the predicted nominal wage rates and the predicted indicators of monetary policy. We obtain equations as follow:

$$w^{e} = 1.220088 + 0.221140M^{-e} \text{ (during 1970s)}$$

$$(7.865)^{*} \quad (3.514)^{*} \qquad R^2 = 0.99$$

$$w^{e} = -3.273653 + 0.930881M^{-e} \text{ (during 1980s)}$$

$$(-39.9)^{*} \quad (10.08)^{*} \qquad R^2 = 0.99$$

for the United States, and

$$w^{e} = 0.025209 + 0.419482M^{-e} \text{ (during 1970s)}$$

$$(3.145)^{*} \quad (6.334)^{*} \qquad R^2 = 0.99$$

$$w^{e} = 0.273694 + 0.104450M^{-e} \text{ (during 1980s)}$$

$$(5.266)^{*} \quad (4.411)^{*} \qquad R^2 = 0.99$$

for the United Kingdom. In these equations, M^{-e} is the predicted indicator of monetary policy, w^{e} is the predicted nominal wage rate, and the asterisk means coefficients are

significantly different from zero at 1% level. The results we have here indicate that the predicted nominal wage rates have positively correlated with the predicted indicator of monetary policy in both the United States and the United Kingdom for the different decades.

In summary, we have the predicted monetary policy controlling the predicted inflation rates and the predicted nominal wage rates for the 1970s and 1980s in the U.S. and the U.K..

3.4.2 The Mean Analysis

As we may see from the trend analyses of both the U.S. and the U.K. data in the previous section, the respective countries shared an accommodative monetary policy in the 1970s, in a move toward monetary discipline in the 1980s, and in the taming of inflation in the 1980s. To consider those changes further, we presently examine the averages for monetary policy indicator and the inflation rate data.

In table 3-1 we show the maximum, minimum, mean, and standard deviation for the indicator of monetary policy for both the U.S. and the U.K.. As for the previous analyses, the overall sample period is split into the two sub-sample periods. In addition to table 3-1, we illustrate the statistical results graphically in figures 3-4a and 3-4b.

Whereas the mean for indicator of monetary policy for the United States in the 1970s is positive (3.388 percent), for the 1980s the mean of indicator of monetary policy takes on a

Table 3-1 MAXIMUM, MINIMUM, MEAN AND STANDARD DEVIATION FOR THE INDICATOR OF MONETARY POLICY

Periods of time	Min.	Max.	Mean	S.D.
United States				
1970s (i-regime)	0.258%	7.463%	3.388%*	1.760%
1980s (M-regime)	-10.98%	7.987%	-0.267%*	4.800%
United Kingdom				
1970s (i-regime)	-5.766%	13.477%	2.642%*	5.290%
1980s (M-regime)	-16.506%	13.188%	-4.141%*	7.011%

The asterisk means of the indicator of monetary policy are significantly different toward one another at 1% level in each country[2]

negative sign (-0.267 percent). Moreover, similar results appear for the United Kingdom. For the U.K. the mean of monetary policy indicator is 2.6421 percent in the 1970s, and the mean of the indicator of monetary policy becomes -4.141 percent for the 1980s. Comparing the U.S. and the U.K. data on the indicator, we see that the U.S. appears somewhat less resolute in taming inflation for a time following the 1981-82 recession and at the close of the 1980s.

Against the background of the indicator results and hypothesis 2 (sect. 1.1.2), we should observe a move from the high inflation rates of the 1970s to lower inflation rates in the 1980s. Infact, the maximum, minimum, mean, and standard

[2] The tests of the significance of the difference between the mean of the indicator of monetary policy are shown in appendix E.

Table 3-2 MAXIMUM, MINIMUM, MEAN AND STANDARD DEVIATION FOR THE INFLATION RATES

Periods of time	Min.	Max.	Mean	S.D.
United States				
1970s (i-regime)				
deflator of GNP	4.7%	9.8%	7.4%*	1.676%
CPI	3.2%	13.5%	7.86%*	3.293%
1980s (M-regime)				
deflator of GNP	2.5%	9.7%	4.43%*	2.263%
CPI	2.0%	10.3%	4.66%*	2.4%
United Kingdom				
1970s (i-regime)				
deflator of GNP	7.0%	27.2%	12.85%*	5.992%
CPI	7.0%	27.4%	13.79%*	5.392%
1980s (M-regime)				
deflator of GNP	3.5%	19.5%	7.65%*	4.999%
CPI	3.5%	11.9%	6.25%*	2.705%

The asterisk means of the inflation rates are significantly different toward one another at 1% level in each country

deviation for the inflation rates in terms of both CPI and the deflator data for both the U.S. and the U.K. support the hypothesis. In table 3-2, the means for the U.S. inflation rate data are 7.4 percent for the deflator and 7.86 percent for CPI per annum in the 1970s and considerably less in the 1980s (4.4 percent for the deflator of GNP and 4.6 percent for CPI respectively). Similar results were found in the case of the United Kingdom, for the U.K. the means for inflation rates are 12.85 percent for the deflator and 13.79 percent for CPI per annum during the period of monetary accommodation, and moving into the 1980s the means are only about half of those in the accommodative period of time.

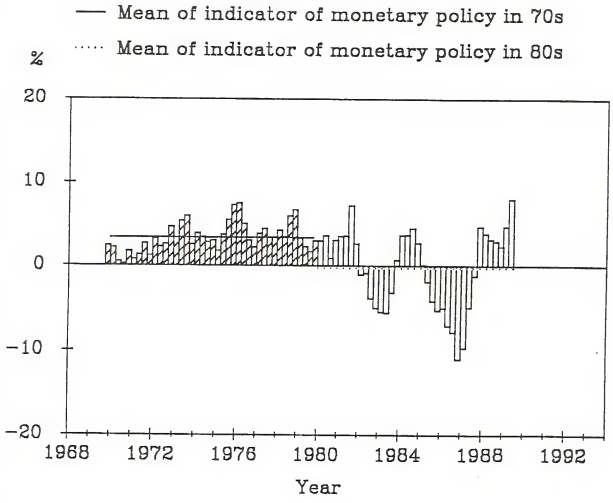

Figure 3-4a The Mean for the Indicator of Monetary Policy 1970s vs 1980s, United States

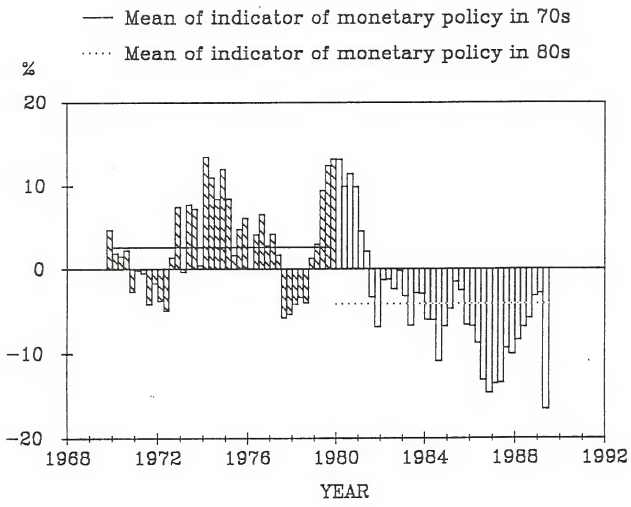

Figure 3-4b The Mean for the Indicator of Monetary Policy 1970s vs 1980s, United Kingdom

Thus, viewing the mean analysis results overall in tables 3-1 and 3-2, the results support hypothesis 2, prices adjust more readily in the presence of monetary discipline. In summary, we see that the indicators of monetary policy moved from positive sign (accommodative) into negative sign (discipline) both in the U.S and the U.K., and that we move from higher inflation rates to a lower inflation rates.

3.5 Summary

Based on the basis of results presented in chapter 3, we find support for hypothesis 1 (sect. 1.1.2). Not only the indicators of monetary policy move parallel in the respective countries (figures 1-1a and 1-1b), the income velocities also move parallel (figure 3-1a and 3-1b). Moreover, these shared results indicate that the demand for money (i.e., the velocity of income) cannot be a random walk as some have maintained. If indeed velocity in each country is a random walk, then the parallel movements we report for velocity will surely not be observed. In setting the new results in opposition to H/E's we support F/S's claim and reject H/E.

Drawing on the indicator and inflation rate results, and others we also find support for hypothesis 2, namely, prices, nominal wage rates adjust more readily in the presence of monetary discipline. Extending the analysis to the nominal wage rates, from figures 1-1a, 1-1b, 3-2a, 3-2b, 3-3a and 3-3b ,not by coincidental, we find that reflecting to the accommodative monetary policy in the 1970s we observed all

positive trend slope both in U.S. and U.K. based on two different prices series for each country, also we find that the series for nominal wages have positively sloping trends in the 1970s and negative trends in the 1980s in both U.S. and U.K. Further, we report that the predicted inflation rates and the predicted nominal wage rates are highly correlated with the predicted indicator of monetary policy. This finding shows that prices and nominal wage rates respond to the changes in the policy indicator. Said differently, monetary policy is controlling the series of prices and nominal wage rates. In the presence of monetary discipline we see prices and nominal wage rates adjust readily.

In addition, we also examined means for the U.S. and the U.K. prices. Via this route, we saw that the means for the prices reflected the mean for the indicator of monetary policy both in the United States and in the United Kingdom. While the indicators of monetary policy move from positive sign (accommodative) to a negative sign (discipline) both in the U.S. and the U.K., the observed prices also responded and moved from high inflation rates to lower inflation rates.

CHAPTER 4
MONETARY POLICY, WAGE, AND PRODUCTIVITY

4.1 Introduction

Hypothesis 3 states that wage rates are determined by productivity and market structures irrespective of monetary policy. This we associate with a theorem due to Sidney Weintraub and Stephen Rousseas (Weintraub 1978, 28-30; chaps. 7-8; Rousseas 1986, 74-77). It is presently viewed as a part of the Keynesian/post-Keynesian analytical system. In Lord Kaldor's terms, the money stock is endogenous to the analytical system. In this view, the explanation for inflation resides in theories of market power, and no attention is given to monetary matters except that fiscal policy is to be accommodated. Here once again we encounter the distinction between the decades of the 1970s and 1980s, along the lines of Keynesian monetary accommodation, on the one hand, and the alternative of monetary discipline to tame inflation, on the other.

Once again in the testing of the hypothesis we also take up the trend paths for the time series at issue and the mean values for the respective decades. This treatment of the data series parallels that of chapter 3.

4.1.1 The Post Keynesian Theory of Inflation

Keynesians from J.K. Galbrath onward have been shown to find the cause of inflation in terms of theories of market power (Frazer 1988, 194-208) rather than monetary forces such as M. Friedman emphasized--even as Friedman rejected theories of market structures other than those for the perfect market and monopoly (Frazer 1988, 306-323). For the present, however, we will focus on the post Keynesian view associated with Weintraub and Rousseas, and juxtapose it with a view we find in the works of Friedman and Frazer. The particular post Keynesians we point to emphasize "oligopoly market power" which permits a mark-up in prices over an historically set wage level. This wage level they see as "the result of the struggle between capital and organized labor over relative shares" (Rousseas 1986, 76). Also in order to put monetary policy into a "sustaining" role the post Keynesians claim that prices are a function of nominal wages, and the wages are exogenously determined by the process of collective bargaining. They view wage compensation as being price neutral (i.e., that wages change prices, but prices do not change wages).[1]

In addition to that view, compensation in terms of money wages takes place according to the average rate of

[1] This neutrality position is the way the post Keynesian proceed in ruling out the prospect for monetary influences on wage. In order for monetary policy to be endogenous in the post Keynesian view they see it as accommodating to fiscal policy to assure full employment.

productivity. Compensation, consequently, is neutral with respect to both the price level and labor's share of income, ceteris paribus. But as post Keynesians raise the issue they must deal with a one sector model, because in a multisectoral model their contention does not hold. We offer a proof in appendix D.

4.1.2 The Rousseas-Weintraub Theorem and Monetary Policy

Along the foregoing lines, we consider the wage theorem which Rousseas finds in Sidney Weintraub's work and calls a major tenet of American post Keynesian economics (Rousseas 1986 73-77; Weintraub 1973, 28-30). We call it the Rousseas-Weintraub wage theorem. It is "that, on the whole, prices are determined by some markup over unit labor costs (Rousseas 1986, 74).", namely:

$$P = k\ (W/Q)$$
$$= k\ (W/L)/(Q/L) \qquad (4.1)$$

Here k is the given degree of monopoly in the economy. It is determined by the exogenous, institutional environment within which each firm operates. The W/Q factor is the ratio of the total nominal wage bill (W) to the level of real output (Q), plus it is a measure of the unit labor cost of producing that the total output. By dividing the total nominal wage bill (W) to the level of real output (Q) by the total labor input (L), we see that the equation becomes:

$$P = k(W/L)/(Q/L) \qquad (4.1)$$

or

$$P = k(w/q) \qquad (4.2)$$

In this equation 4.2, w is the average annual wage rate in nominal terms, and q the average productivity of employed labor. It is assumed to grow at a relatively constant rate over time.

Continuing Rousseas says, "If the relative increase in the nominal wage rate exceeds that of the average productivity of labor ($w^0 > q^0$), prices will rise (Rousseas 1986, 74)." He writes,

$$P = P(w) \qquad (4.3)$$

In this case, w is exogenously determined by the process of collective bargaining. "In short," Rousseas says, "prices are a function of nominal wages (Rousseas 1986, 74)," and the two are positively related. Thus we have a major tenet of American post Keynesian economics, which is "prices are a function of nominal wage (Rousseas 1986, 75)."

Via this route, the post Keynesians attempt to nullify the role money plays in determination of the price level. In doing so they put power theories of inflation central to their view of inflation. Rousseas says:

> Essentially,..., as long as money wages are exogenously determined around the bargaining table, monetary policy has only an indirect link to the price level. (Rousseas 1986, 77)

Further, the post Keynesians put monetary policy into only a "sustaining" role. Rousseas says:

> The increase in nominal income, due to a rise in unit labor costs results in an

> increased transactions demand for money for any given level of real output. Therefore, if [in order] real output and employment are to be maintained, the supply of money will have to increase ... (Rousseas 1986, 75)

This position is very much that of Lord Kaldor, as taken up by Frazer (Frazer 1988, 97-98, 545, 740; and 1991a, sects. 3.5c-3.5e). Continuing Rousseas says, "If, as Weintraub assumes, the velocity of circulation is constant, a full accommodation will be required." (Rousseas 1986, 75) He then says:

> If the central bank flatly refuses to increase the money supply, then the resulting excess demand for money will cause interest rates to rise with the expected Keynesian result of a fall in investment leading to a decrease in real output and employment... (Rousseas 1986, 75)

Returning to the connection with Kaldor, we find him saying the following:

> At any time, or at all times, the money stock will be determined by demand, and the rate of interest determined by the central bank. (Kaldor 1982, 24)

To argue the endogeneity of money supply further, Kaldor says the monetary authorities have no choice but to accommodate the "needs of trade." He says:

> The central bank cannot refuse the discounting of 'eligible bills' rendered to it.... Precisely because the monetary authorities afford the disastrous consequences of a collapse of the banking system... the 'money supply' in a credit-money economy is endogenous, not exogenous--it varies in direct response to changes in the public 'demand' to hold cash and bank deposits and not

> independently of that demand. (Kaldor 1982, 47)

In summary, the post Keynesian inflation theory may be stated as follow. First, the government starts deficit spending to achieve full employment, which in turn would depends on credit expansion. Second, with the central bank keeping open the discount window on an unlimited basis and fully meeting support for credit expansion, the money supply accelerates. However, for the post Keynesians this policy of accommodation has no bearing on cost pressures which may get push forward.

4.2 Frazer/Friedman Wage Bargaining Theory

In this section, we take up Friedman's early work on the relationship between the wage rate and the expected prices level, which Frazer embellished. In Frazer's analysis monetary policy not only plays role in influencing price level but it also influences the wage rates through the wage bargain process and the presence of price indexes in labor contracts (Frazer 1991a, sect. 12.3).

4.2.1 Frazer's Analysis

Frazer offers a monetary approach to the analysis of price averages, wage adjustments, and production (1980, sect. 17.2 and 1991a, sect. 12.3). In it he achieves a compatitability with Friedman's long run view of the Phillips curve (Friedman 1982 sect. 12.2; Frazer 1991a, sect. 12.2).

The monetary analysis is in a dynamic context where production (Q) is moving along a trend path at full employment

(Q_f, say production at the "natural" or noninflationary rate of employment). Indeed, the actual production (Q) may be viewed in relation to this trend path(i.e., Q/Q_f) such that the actual rate varies about the full employment rate (namely, $|Q-Q_f|$).

As an illustration, Frazer offers what we show as figure 4-1. There a price index appears on the vertical axis and the ratio of output to full employment output appears on the horizontal axis. On the plane determined by these axes, supply and demand curves are imposed, by analogy to Marshall's cross. The demand curve slopes downward, and the supply curve, as shown, is kinked at full employment output denoted by the Q/Q_f ratio where actual output equals full employment output ($Q=Q_f$ or $Q/Q_f*100 = 100$ percent). As with Marshall's cross, costs underlay the derivation of the supply curve, plus labor costs (wages) are the major component of costs. There are labor unions and production is accounted for mainly by large manufacturing firms. In addition, the unions have cost-of-living classes in the wage contracts and relate the reality and prospect of inflation to higher nominal wages.

By the same taken Frazer relates the prospect of inflation and wage adjustments to monetary accommodation and discipline such as we defined in section 1.1.1. An illustration of the analysis in reference to figure 4-1 starts with inflation in progress at point A, which occurs at over-full employment ($Q > Q_f$). Under such occurrence there is

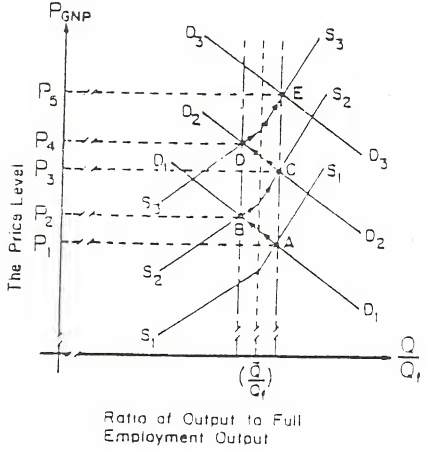

Figure 4-1 The Price-Output-Wages Connection
Aggregate Demand and Aggregate Supply
Source: Frazer Alternative Analytical System 1991a, 354

little discipline on the wage bargain between the two sides of industry and wages are pushed higher (even in excess of full employment wage rates). Acting to assure "full employment" at any inflation rate, the monetary authority accommodates inflationary wage increases via the management of aggregate demand. The demand curve shifts (say, from D_1D_1 to D_2D_2), and higher wages and inflation rates are accommodated. The issue of accommodation and "sticky wages" (as oppose to wage adjustments) is enjoined such as was set on a causes by J. M. Keynes and Winston Churchill in the 1920s (Keynes 1925; Frazer 1988, 419-421).

The issue is later joined by Margaret Thatcher(Frazer 1988, chap. 15 and 1991a, sect. 12.3). The alternative she poses is wage adjustment. Thatcher said:

> Supposing we start off with inflation. You have it We have it, at very high rates. Rates that have gone up over the last decade to far higher rates than we would have thought possible. And you also have a certain amount of unemployment. Now you can do two things. You can reflate. That means sticking inflation on top of inflation, and what I would call "suitcase money." Germany had it after the first World War. When you get that you get unemployment on a colossal scale. Now what's the alternative policy? You've got inflation. You try to pursue policies that will get the inflation down. That means not having so much surplus money in the economy so that prices come down. Unless people condition their wage claims to the lesser amount of money, then there'll be some unemployment. What usually happens is that people still want to take out quite a lot for themselves, they leave less over for others, and it comes out in unemployment. But in the longer run, you'll not get a competitive industry, good secure jobs unless your costs are competitive with other people's. That means fighting inflation now, it means short

> run unemployment, but long term good jobs, good prosperity, good prospects. (Frazer 1988, 611)

The alternative Thatcher posed in relation to the monetary accommodation was monetary discipline which we introduced in section 1.1.1.

Now, the matter we address for the 1980s need not be viewed differently from that engaged in by Reagan's Presidency or Thatcher's government. Moreover, the effectiveness of the policy need not be viewed independently of Reagan's confrontation with the air traffic controllers and Thatcher's confrontations with the coal miners. Having an understanding of the policy and its intents on the part of workers, unions, and the general public can only improve the effectiveness of the policy.

Frazer's analysis as just outlined is very much what we take up. It may be aligned with Friedman's approach as well.

4.2.2 Friedman's Analysis

In order to clarify whether the causation is running from ΔW to ΔP or ΔP to ΔW, we temporarily neglect Friedman's newer version of the Phillips curve in Monetary Trends (1982). In the old version, if the Phillips curve reflected labor supply behavior then Friedman was insisting that the Phillips curve was a wage bargaining relationship. In it, the workers could at best only take into account the expected rate of inflation in the wage bargain. Thus we have

$$W^0 = a_0 + a_1 U + a_2 P^{0e} \qquad (4.4)$$

where U is unemployment rate and P^{0e} is expected inflation

rate. In words, wages are determined by unemployment (U) and

inflationary expectations (P^{0e}). Further, in his view of the formation of inflationary expectations Friedman adopted an adaptive framework (Friedman 1969, 124). In it P^{0e} is a weight average of previous P^0, namely:

$$P^{0e} = \Omega \sum_{i=0}^{\infty}(1-\Omega)^i P^0_{t-i}, \quad 0<\Omega<1 \qquad (4.5)$$

where $(1-\Omega)$ is the weight attached to actual inflation which decays as one goes back from the current period into the distant past. When $\Omega=1$, $P^{0e}=P^0$, i.e., inflation is fully anticipated. When $\Omega=0$, expected inflation bears no relation to the history of actual inflation rates.

Combining (4.5) and (4.4) we have

$$W^0_t = a_0\Omega+a_1U_t+a_1(1-\Omega)U_{t-1}+a_2\Omega P^0_t+(1-\Omega)W^0_{t-1} \qquad (4.6)$$

Here the coefficient of P^0 is now a combination of the speed of adaptive expectation Ω as well as the extent to which inflationary expectations are incorporated into the wage-bargain equation [i.e., equation (4.4)].

Retaining his quantity theoretic relation and causation running from money (M) to Income (Y), Friedman reverses the Keynesian/post-Keynesian view of causation. In addition, he explains the Phillips curve as a wage bargaining relation where he introduce a distinction between actual and expected rate of inflation in equation (4.4). Where the Keynesians have only the inflation rate, Friedman substitutes the expected inflation rate. In effect we do not know the current

inflation rate in the current period. We have only the expected rate. So the worker can at best take into account the expected rate of inflation and this may be influenced by monetary policy (Friedman, 1969).

4.2.3 The Alternative--a Restatement

As we move further into the matters of wages, productivity, and monetary discipline as opposed to monetary accommodation, the post Keynesians reinter the picture. They do so by taking up a statement due to Keynes in the General Theory (1936, 8), notably: " [It] may be the case that within a certain range the demand for labor is for a minimum money wage and not for a minimum real wage". Along this line the Rousseas Weintraub's wage theorem says $P = k(W/Q)$ (Weintraub, 1978 28-30) where we have the money wage in relation to output [i.e., $W/Q = (W/L)/(Q/L) = w/q$]. In addition, from the ratio w/q, we may take a logarithm, we then have $\ln w - \text{Ln } q$ and treating each term as time rate of change (in percent) we have $(1/w)(dw/dt)*100 - (1/q)(dq/dt)*100$. This turns out to coincide with the information illustrated in figures 4-2a and 4-2b. As we pointed out in the earlier sections, in order to put monetary policy into a "sustaining" role the post Keynesians claims that prices are a function of nominal wages, and wages are exogenously determined by the process of collective bargaining. They ensure that causation runs only from $\Delta(W)$ to $\Delta(P)$, and not the reverse, but we have already proven this approach to be flawed (appendix D). In this

flawed approach monetary policy is in a "sustaining" role, and the stock of money is endogenous. In summary, Kaldor said the money supply cannot be exogenously determined (Kaldor 1982, 46-47).

However, in juxtaposition to all of this Keynesian/post-Keynesian approach, we have a Frazer/Friedman wage bargaining theory, which contains elements of Frazer's analysis (sect. 4.2.1) and Friedman's (sect. 4.2.2). As introduced in Frazer's overshooting model (1991a, section 12.3), with its parallel to Friedman's treatment of transitory and permanent components in the data series, the wage costs in labor contracts are tied to a cost of living index and monetary induced price changes. Via this route, wage bargaining is determined by agents' expected rate of inflation, as in Friedman's discussion, so we have the Frazer/Friedman wage bargaining theory.

4.3 Testing the Hypothesis

In this section we are going to test hypothesis 3. In opposition to the post Keynesian's monetary accommodation position, Frazer/Friedman provide monetary discipline and wage adjustments to assure noninflationary output growth at full employment. In opposition to hypothesis 3 (sect. 1.1.2), we have an alternative-- i.e., monetary policy not only plays a role of influencing the price level but also in influencing the nominal wage rate and imposing some discipline on wage bargaining process. This appears in term of labor contracts

which include cost of living indexes (Frazer 1991a, sect. 12.3), and in other was which impact on the relation between wages and productivity.

In the present testing, we once again first consider trends (figures 1-1a, 1-1b, 4-2a and 4-2b) and the related results. We then look at the average for the split sample (figures 4-4a and 4-4b) and the related results. In doing so we are presently denoting the difference between the growth in the wage and productivity in percentage as pointed out above. For now $W^{\sim} = [(1/w)(dw/dt)*100] - [(1/q)(dq/dt)*100]$. This usage with respect to the symbols parallels that shown earlier for the monetary indicator (sect.1.1.1).

4.3.1 The Trend.

Recall that in section 3.2, and figures 1-1a and 1-1b, we have the trend for the indicator of monetary policy for both the U.S. and the U.K. In equations form, these trends are

$$M^{\sim} = 2.440101 + 0.2772t \quad \text{(during 1970s)}$$
$$(8.456)^{*} \quad (2.9785)^{*}$$

$$M^{\sim} = 2.558236 - 0.1794t \quad \text{(during 1980s)}$$
$$(9.225)^{*} \quad (-2.6246)^{*}$$

for the United States; and

$$M^{\sim} = 1.599123 + 0.1776t \quad \text{(during 1970s)}$$
$$(4.1175)^{*} \quad (2.6016)^{*}$$

$$M^{\sim} = 22.53880 - 1.8899t \quad \text{(during 1980s)}$$
$$(8.9241)^{*} \quad (-4.5112)^{*}$$

for the United Kingdom. In these equations, t is time, and

$M^{\sim}$ is the indicator of monetary policy. The asterisk means that the coefficients are significantly different from zero at 5% level of significance.

In these equations, we see a significant difference between the monetary regimes of the 1970s and 1980s respectively. Moreover, an empirical questions arise, notably: If the inflation is caused by monetary forces (accelerated money growth), and not by non-monetary forces (market structure power theories of inflation) as Rousseas says, then we should see the time series for wages and productivity reflecting the change in the monetary regimes. With the governments adopting a Keynesians full employment goal, without regard for inflation, it proceeds to accommodate its policy to suit inflation and wages.

In contrast, in the 1980s by gradual deceleration of growth in the money supply and achieving monetary discipline, the governments may expect the private sector's wages to adjust and ultimately to achieve employment up to the natural rate. Under this regimes, the growth in wages is expected to slow down and, if pursued long enough to become negative (Frazer 1991a, sect. 12.3).

Now, we considers the trend line for the difference between the growth in the wage (expressed as percentage) and the rate of change in productivity (expressed as percentage), which we shown in figure 4-2a and 4-2b for both the U.S. and the U.K. The equations we obtained are

$W^{\sim}$= 4.029923 + 0.4606t (during 1970s)

(46.221)* (4.674)*

$W^{\sim}$= 15.330757 - 0.7703t (during 1980s)

(65.142)* (6.873)*

for the United States; and

$W^{\sim}$= 2.368125 + 0.1325t (during 1970s)

(4.462)* (3.119)*

$W^{\sim}$= 6.103434 - 0.3183t (during 1980s)

(5.387)* (7.093)*

for the United Kingdom. In these equations, $W^{\sim}$ is the difference between the growth in wages and the growth in productivity [(1/w)(dw/dt)*100 - (1/q)(dq/dt)*100], q is output per hour of all persons, w is hourly compensation.

Considering the results just shown, we see a significant difference between two decades for the trend lines for both the U.S. and the U.K.. As we recall figures 1-1a, 1-1b, and section 3.2, the 1970s were characterized by an upward trend in the indicator of monetary policy for both the U.S. and the U.K.. In the same period, the trend for the difference between the growth in wages and the rate of change in productivity ($W^{\sim}$) was upward by almost 0.5 percent per annum in the case of U.S., and the trend was upward by almost 0.15 percent per annum in U.K. In addition, the indicator of monetary policy turns from a positive slope to a negative slope for the 1980s in both countries (figures 1-1a and 1-1b; sect. 3.2). The trend for $W^{\sim}$ was downward by almost

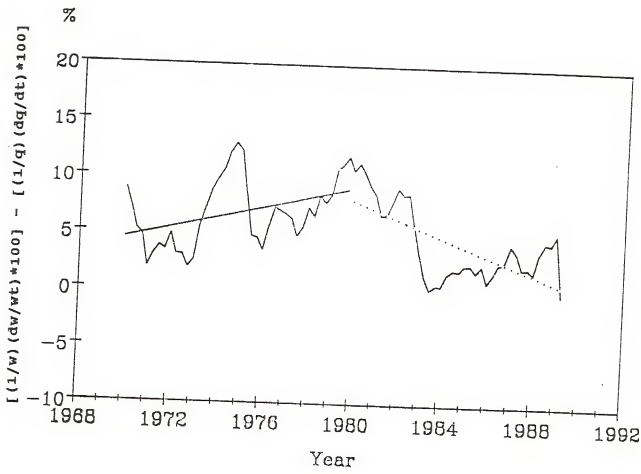

Figure 4-2a Trend Line for the Difference Between the Growth in Wages and the Growth in Productivity U.S.

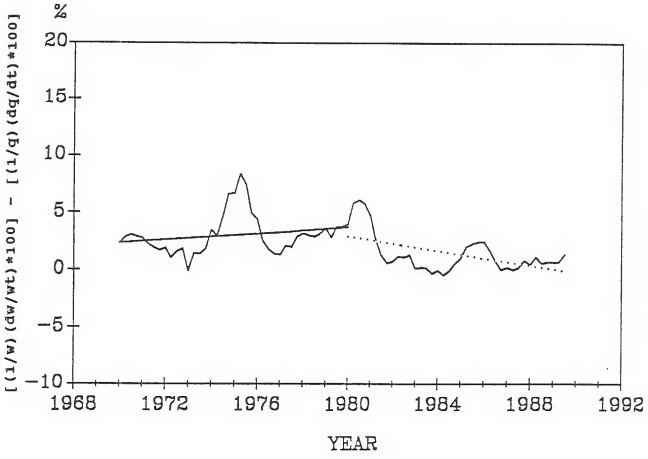

Figure 4-2b Trend Line for the Difference Between the Growth in Wages and the Growth in Productivity U.K.

0.8 percent per annum in U.S. and by almost 0.32 percent per annum in U.K. This shows that the change of monetary policy, which we observe in term of the indicator of monetary policy, has strong impact on the series for $\dot{W}$ which we shown in the figure 4-3a and 4-3b. There we see the difference between the growth in the wage and the rate of change in productivity ($\dot{W}$) getting narrow when monetary policy moves from an era of accommodative to an era of discipline. These differences appear not only in the U.S. but also in the U.K.. Interestingly, the $\dot{W}$s for the U.S. and the U.K., both were upward when the trends for the monetary indicator were upward, and both were downward when the trends for the monetary indicator moved into a negative direction. This is consistent with our discussion that when the government adopts a full employment goal without regard for inflation, there were a wage boost when followed an accommodative monetary policies. In contrast, under more disciplined monetary policies wage rates adjusted downward.

The trend for $\dot{W}$ and $\dot{M}$ (figures 1-1a, 1-1b, 4-2a, and 4-2b) which we found in the last two decades for both the U.S. and the U.K. is exactly what we expect from the Frazer/Friedman wage bargain theory, and it is unlike what we expect from the tenet of post Keynesian economics, where the wages are exogenously determined and in turn determine the price level. Now, in order to verify the relationship between

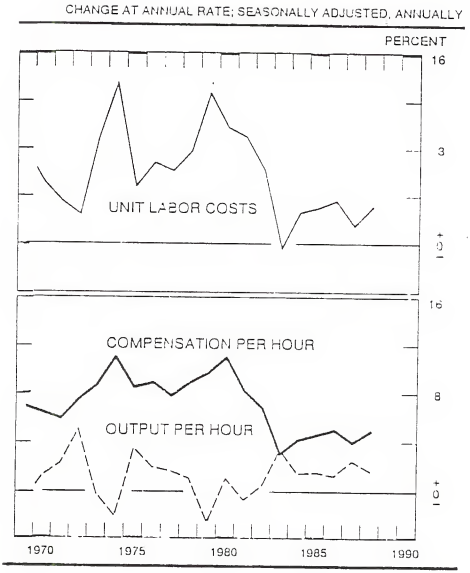

Figure 4-3a The Difference Between the Growth in Wages and the Growth in Productivity, U.S.
Source. : Ferderal Reserve Bank of St. Louis.

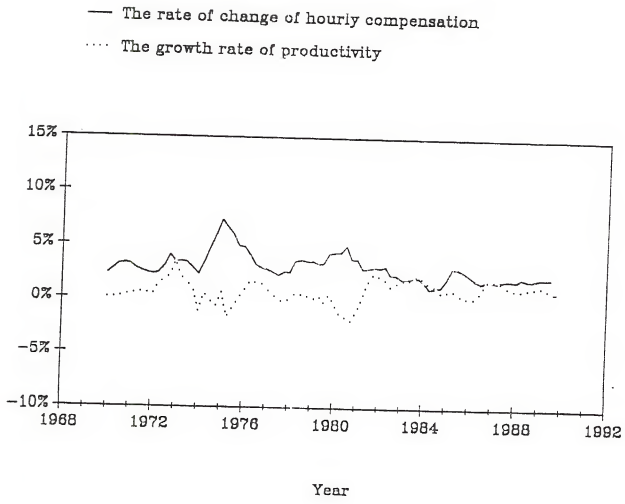

Figure 4-3b The Difference Between the Growth in Wages and the Growth in Productivity, U.K.

the difference between the growth in the wage [(1/w)(dw/dt) *100 for percent] and the growth in productivity [(1/q)(dq/dt) *100 for percent] and the indicator of monetary policy (sect. 1.1.1), we move one step further and examine the relationship for the 1970s and 1980s decades respectively.

Following Friedman's uses of statistical methods (sects. 2.2.1 and 2.2.2) a summary of statistical results appear in tables 4-1 and 4-2. In addition to the simple relation

$$W^{\sim}=a+bM^{\sim} \qquad (4.7)$$

, we add to the summary of results an assessment of the interaction between the variables in the simple relation and their interaction with time. In this respect we write two additional equations,

$$W^{\sim}=a+bM^{\sim}+ct \qquad (4.8)$$

$$W^{\sim}=a+bM^{\sim}+ct+dtM^{\sim} \qquad (4.9)$$

and show the best fit results presented in appendix C. The best fit results were obtained there using the "F test" which was also discussed in the appendix C.

Applying the "F test" we have the trend lines yielding the best fits for both countries. These "best fit" lines are for equation (4.8) in both countries, but the coefficient c in equation (4.8) appears along with the dummy variable t (for the different periods; t=1 for the 1970s and t=0 for the 1980s). The results obtained via this route are as follows:

$W^{\sim}= 0.060021 + 1.146593M^{\sim} - 0.020476t$

Table 4-1 SUMMARY FOR FITTING MODEL BETWEEN M^- AND W^-, UNITED STATES

Variables or Statistic	Equation		
	$W^-=a+bM^-$	$W^-=a+bM^-+ct$	$W^-=a+bM^-+ct+dtM^-$
Intercept	0.055536*	0.060021*	0.059964*
M^-	0.869596*	1.146593*	1.151359*
t	--	-0.020476*	-0.019907*
M^-t	--	--	-0.021829*
R^2	0.3197	0.7223	0.7223
SSE	0.00411	0.00167	0.00167
TSS	0.00605	0.00605	0.00605

The asterisk means the coefficient significantly different from zero at 5% level

Table 4-2 SUMMARY FOR FITTING MODEL BETWEEN M^- AND W^-, UNITED KINGDOM

Variables or Statistic	Equation		
	$W^-=a+bM^-$	$W^-=a+bM^-+ct$	$W^-=a+bM^-+ct+dtM^-$
Intercept	0.024443*	0.025145*	0.024389*
M^-	0.226707*	0.231713*	0.207438*
t	--	-0.001347	-0.003272
M^-t	--	--	0.161194*
R^2	0.6204	0.8449	0.8892
SSE	0.00063	0.00025	0.00018
TSS	0.00166	0.00166	0.00166

The asterisk means the coefficient significantly different from zero at 5% level

in other words, we have

$$\tilde{W} = 0.039554 + 1.146593\tilde{M} \quad \text{(during 1970s)}$$

$$\tilde{W} = 0.060021 + 1.146593\tilde{M} \quad \text{(during 1980s)}$$

for the United States. And

$$\tilde{W} = 0.025145 + 0.231713\tilde{M} - 0.001347t$$

in other words, we have

$$\tilde{W} = 0.023798 + 0.231713\tilde{M} \quad \text{(during 1970s)}$$

$$\tilde{W} = 0.025145 + 0.231713\tilde{M} \quad \text{(during 1980s)}$$

for the United Kingdom. In both countries we see a positive relationship between the indicator of monetary policy ($\tilde{M}$) and the difference between the growth in the wage and the growth in productivity ($\tilde{W}$). These results are unfavorable for the post-Keynesian view and favorable to the monetary view. Moreover, we have a repetitive results both for U.S. and U.K. in two different decades, and these reflect the stable relationship in term of Friedman's definition.

Continuing to pursue the methods we introduced in section 2.3, we now turn to examining the upper and lower bounds on the "true regression coefficient." For now, we have two regressions. One is the difference between growth in wage and the growth in productivity ($\tilde{W}$) in relation to the indicator of monetary policy ($\tilde{M}$), namely: $\tilde{W} = a + b\tilde{M}$. The other is the indicator of monetary policy ($\tilde{M}$) in relation to the difference between growth in wage and the growth in

Table 4-3 THE UPPER AND LOWER BOUND ESTIMATION FOR THE DIFFERENCE BETWEEN GROWTH IN THE WAGE AND THE GROWTH PRODUCTIVITY AND THE INDICATOR OF MONETARY POLICY U.S.

Variables or Statistic	Lower	Upper
Intercept	0.060021*	0.0413024*
M^-	1.146593*	2.6931674*
t	-0.020476*	-0.0472166*
R^2	0.7223	0.5602
SSE	0.00167	0.00112
TSS	0.00605	0.00255

* means the coefficient significantly different from zero at 5% level

Table 4-4 THE UPPER AND LOWER BOUND ESTIMATION FOR THE DIFFERENCE BETWEEN GROWTH IN THE WAGE AND THE GROWTH PRODUCTIVITY AND THE INDICATOR OF MONETARY POLICY U.K.

Variables or Statistic	Lower	Upper
Intercept	0.025145*	0.0267108*
M	0.231713*	0.2819886*
t	-0.001347	-0.0038973
R^2	0.8449	0.8553
SSE	0.00026	0.00395
TSS	0.00166	0.02731

* means the coefficient significantly different from zero at 5% level

productivity ($W^{\sim}$), namely: $M^{\sim} = c + d\,W^{\sim}$. But on this equation we perform algebraic operations (F/S 1982, 221-238) to obtain an equation $W^{\sim} = a_1 + b_1 M^{\sim}$, from the results for $M^{\sim} = c + d\,W^{\sim}$. The two sets of results then become the upper and lower bounds on the "true regression coefficient."

Table 4-3 and 4-4 give, in columns 1 and 2 , the numerical estimates coefficient for these regressions for the U.S. and U.K. respectively. For the U.S. there are:

$W^{\sim}$= 0.039554 + 1.146593$M^{\sim}$ (lower bound 1970s)

$W^{\sim}$= -0.005914 + 2.693167$M^{\sim}$ (upper bound 1970s)

$W^{\sim}$= 0.060021 + 1.146593$M^{\sim}$ (lower bound 1980s)

$W^{\sim}$= 0.041302 + 2.693167$M^{\sim}$ (upper bound 1980s)

for the U.K. the equations are:

$W^{\sim}$= 0.023798 + 0.231713$M^{\sim}$ (lower bound 1970s)

$W^{\sim}$= 0.022813 + 0.281988$M^{\sim}$ (upper bound 1970s)

$W^{\sim}$= 0.025145 + 0.231713$M^{\sim}$ (lower bound 1980s)

$W^{\sim}$= 0.026710 + 0.281988$M^{\sim}$ (upper bound 1980s)

Here the relation between the $W^{\sim}$ and the $M^{\sim}$ either in the lower bound estimation or in the upper bound estimation have a positive relation. This states that monetary policy has a positive influence on the wage rate. And the significance of the coefficients indicates that there is a positive correlation among the indicator of monetary policy ($M^{\sim}$) and the difference between the growth in the wage and the growth in productivity ($W^{\sim}$) in the last two decades. To be sure, this is not supportive of the post Keynesian's position that

money plays no role in determining inflation and wage rates. As long as the indicator of monetary policy was upward, which means an accommodative monetary policy, we also find the difference between the growth in the wage and the growth in productivity gets wider. When the indicator of monetary policy was downward, which means monetary discipline, the difference between the growth in the wage and the growth in productivity are narrowing. These results are supportive of the Frazer/Friedman wage bargain theory and monetary view.

4.3.2 The Mean.

Parallel to the treatment in chapter 3, we again consider figure 3-4a and 3-4b, and examine the mean for the indicator of monetary policy for both the U.S. and the U.K., and we recall the data summarized in table 3-1. In summary, the monetary policy changed from accommodation to a period of discipline as we move from the 1970s to the 1980s.

We see that a significant difference exists between two policy regimes in term of the mean of the indicator of monetary policy both in the U.S. and in the U.K.. Reflecting upon these differences, a question arises, namely: if the Frazer/Friedman wage bargaining theory holds and if the inflation is caused by monetary forces rather than by non-monetary forces, then we should be able to observe changes in the series for wage and productivity as a possible response to the changing monetary policy. Since the indicator for monetary policy moves from a positive sign (accommodative) to

a negative sign (discipline) both in the U.S and the U.K., we should observe a decline in the ratio of wages to productivity (i.e., w/q and taking the logarithm of the ratio, as in section 4.2.3 we have a decline in the difference between the growth in the wage and the growth in productivity).

Along this route, we calculate the maximum, minimum, mean and standard deviation for the difference between the growth in the wage and the growth in productivity. Taking note of two different policy regimes, we find that the difference between the growth in wages and the growth in productivity decline not only in the U.S. but also in the U.K., as we move from the 1970s to the 1980s. During the periods of monetary accommodation the mean of the difference between the growth in the wage and the growth in productivity is 6.735 percent in the U.S. and 3.014 percent in the U.K., whereas during the periods of monetary discipline the mean of the difference between the growth in the wage and the growth in productivity declines to 4.477 percent in the U.S. and 1.407 percent in the U.K..

These differences for the respective regimes periods are significantly different from one another at the 1 percent level of significance for each country.

These results are shown in figure 4-4a and 4-4b for the U.S and the U.K., respectively. And again they are consistent with the hypothesis advanced by Frazer and Friedman that the inflation numbers are generated by monetary forces (namely

accelerated money growth). In this respect we have referred to Frazer/Friedman wage bargaining theory which holds that monetary policy has impact on the difference between the wage rate and productivity. This view is distinct from the hypothsis that the difference cited is caused by non-monetary forces (market structure power theoriesof inflation), such as we find in the post Keynesian economics.

4.4 Summary

In summary, hypothesis 3 says: wage rates are determined by productivity and market structures irrespective of monetary policy. This we associate with a theorem due to Sidney Weintraub and Stephen Rousseas and relate as well to the post Keynesian view about an endogenous money supply.

Table 4-5 MAXIMUM, MINIMUM, MEAN AND STANDARD DEVIATION FOR THE DIFFERENCE BETWEEN THE GROWTH IN WAGES AND THE GROWTH IN PRODUCTIVITY

Periods of time	Min.	Max.	Mean	S.D.
United States				
1970s (i-regime)	1.900%	12.921%	6.735%*	3.052%
1980s (M-regime)	0.257%	11.337%	4.477%*	3.259%
United Kingdom				
1970s (i-regime)	-0.104%	8.329%	3.014%*	1.767%
1980s (M-regime)	-0.484%	6.081%	1.407%*	1.712%

The asterisk means of the difference between the growth in wage and the rate of change in productivity are significantly different from one another at the 1 percent level in each country.[2]

[2] The tests for the significance of the difference between the mean of the indicator of monetary policy is discussed in appendix E.

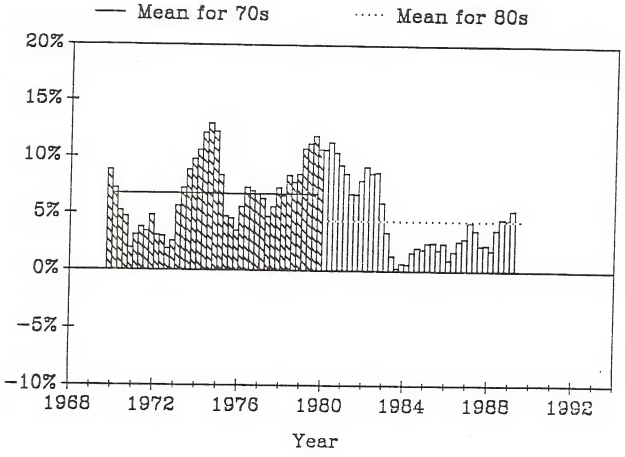

Figure 4-4a The Mean for the Difference Between the Growth in Wages and the Growth in Productivity 1970s vs 1980s, U.S.

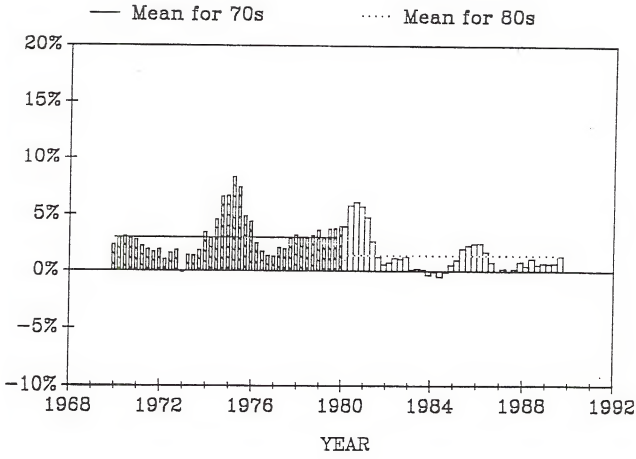

Figure 4-4b The Mean for the Difference Between the Growth in Wages and the Growth in Productivity 1970s vs 1980s, U.K.

In opposition to this we have the prospect of monetary restraint (discipline) and wage adjustments to assure noninflationary output growth. It is a Friedman/Frazer view in which the wages are determined by bargaining between the labor and management sides of industry and the principals' expected rate of inflation. In this Friedman/Frazer wage bargaining theory, monetary policy plays the role of influencing the price level and the nominal wage rate. In this approach the prospect is left open as to whether swings between monetary accommodation and discipline influence the productivity of the workers (Frazer 1991a, sect. 12.3).

We examine this issue with respect to the trends combination of nominal wages, productivity, in the one case, and monetary accommodation and discipline, in another case. We also take up the differences between the 1970s and 1980s decades by looking at average values and standard deviations for the difference in percentage points between the wage growth and the productivity growth, in the one case, and the indicator of monetary accommodation (or discipline), in the other case.

We conclude that hypothesis 3 is rejected. Also in the results we present in section 4.3, we observe a shared experience in both the U.S. and the U.K. In both countries we see a positive relationship between the indicator of monetary policy (M^{-}) and the difference between the growth in the wage and the growth in productivity (W^{-}). Moreover, we have a

repetition of results both for the U.S. and the U.K. in two different decades. This is reflecting the stable relationship in term of Friedman's definition. As long as the indicator of monetary policy moves upward, which means accommodative monetary policy, we also find that the difference between the growth in the wages and the growth in productivity moves upward. When the indicator of monetary policy moves downward, which means monetary discipline, the difference between the growth in the wages and the growth in productivity also moves downward. This shared experience in both countries again shows the impact of monetary policy on the series we undertake for study and this, furthermore, adds to the support for hypothesis 1, in section 1.1.2.

CHAPTER 5
THE SAMPLE PERIODS, THE ANALYSIS OF DATA, AND THE HYPOTHESES

5.1 Introduction

Over the post World War II years in economics there has been for the most part the econometric method for the analysis of time series which F/S called "the prevailing fashion in econometric work." As reviewed by Frazer (1988, 68-87) it followed the course set by Nobel laureates Ragnar Frisch and Jan Tinbergen and taken up by the Nobel laureate Lawrence Klein. The major alternative which emerged to challenge this approach has come at the hands of Milton Friedman, but it did so as a part of Friedman's doing economics and analyzing data for the most part, rather than from Friedman's writing about the uses of statistical methods.[1] The arguments and debates have been numerous and intense and widely reported with references to the big models, reduced forms, simple models, exogenous and endogenous variables, causation, multiple

[1] However, we may point out that Frazer interviewed Milton Friedman on the subject of his uses of statistical methods after he published (with Boland) appear titled "An Essay on the Foundations of Friedman's Methodology" (1983). Results from the interview appear in an unpublished document Frazer wrote with econometrician Kim Sawyer (1984) and in Frazer (1988, chaps. 3 and 18). In addition, Frazer studied all facts of Friedman's uses of methods as they appear in Friedman's paper and books in economics.

regression equation, the bounds on "true regression coefficients," the Leamer problem, the filtering of the data, and "the prevailing fashion in econometric work" (Frazer 1973, chaps. 5 and 9; 1988, 68-87 and chap 18; Frazer and Sawyer 1984).

We make no attempt to review all of the above, although all of the analytical problems and conflicts appear in this dissertation. Rather than reviewing the latter, we do four things, notably: (1) introduce four hypotheses (sect. 1.1.2), the last of which specifically addresses the use of statistical methods; (2) narrow the focus of controversy to what Frazer called " the separation of effects problem" (sect. 2.3); (3) take up such crucial matters as episodes, the filtering of time series data, and the setting of bounds on the true regression coefficients; and (4) focus upon some time series of a rather crucial nature as they relate to monetary policy and overall economic performance for the U.S. and the U.K. economies. The time series and data sources we presently rely upon are listed in section 1.3.3.

In hypothesis 4 "the prevailing fashion in econometric work" is said to be appropriate for the analysis of the time series. The approach, we said, gives secondary attention to episodes, and proceeds as if information is expected to be obtained from an unchanging universe.

In contrast to that method, we introduce uses of statistical methods which Frazer attributes to Friedman (1988,

68-87). Going that route Friedman adapts a Bayesian approach to the extent (1) that episodes move the series, (2) that agents learn, and (3) that Friedman attempts to separate the repetitive from the non-repetitive or episodic part of the time series. In addition, Friedman draws no distinction between the agents forming expectations along classical probability lines and otherwise having incomplete information. The probability and the incomplete information are one and the same and agents may view outcomes stochastically, as they obtain new information and revise their prior view.

The role we attribute to episodes in this foregoing context (sect. 1.2) becomes a primary distinguishing feature in the way Friedman proceeded in the use of statistical methods and in the way Frazer introduced Bayesian learning and rationality on the part of economic agents (Frazer 1873, chap.8; 1978; and 1991a, sects. 1.1, 2.2c, 7.2c, and 14.2c). This revision of prior view is particularly visible in the role of psychological time (Frazer 1988, 731) which simply gives further attention to episodes.

In confronting "the prevailing fashion in econometric work," special analytical problems in the analysis of data are encountered, which we summarized in chapter 1 and sections 2.2 and 2.3. But these reduce primarily to one problem, namely, the separation of effects in the time series. In broad outline, as taken up by Friedman and Frazer, there are special time frames and different classes of information contained in

even a single time series of the sort monetary officials confront (chap.1 and sects. 2.2 and 2.3). The time frames are the very short run of Keynes's General Theory and monetary crises as a rule, the short cycle (as delineated by the NBER's reference dates for peaks and troughs in the transitory part of the time series), and Friedman's long run (i.e., the trends or permanent components in the time series). Episodes may enter in each of these time frames, and particularly for the present purpose we have focused on trends-- for the 1970s and the 1980s, respectively-- which we identify with distinct approaches to monetary policy (sect. 1.2.1) and even with different political regimes.

Going beyond the information contained in a given time series, numerous time series may be sharing in the reactions to episodes of the sort we point to and take up in the discussion of exogenous and endogenous variables (sect. 1.2 and appendix A). When this occurs, the changes in the series are rarely independent of one another and may indeed most commonly be responding to shared forces. Such possible occurrences were illustrated with equation (2.1), section 2.3.

5.2 A Use of Conventional Method

Recall that in section 4.3.1 we examined the relationship between the indicator of monetary policy (M^-) and the difference between the growth in wages and the growth in productivity (W^-) following Friedman's method (sect. 2.2). In it, Friedman gives attention to the simple regression

technique and to the bounds on the true regression coefficient (sects. 4.3.1 and 5.3). However, in the present section, we take up the conventional method which we find in the work of econometricians Hendry and Ericsson (1990). That work proceeds as if the sampling is from an unchanging universe, and quite separate from the time frame distinctions Friedman draws (sect. 1.3.2). In addition, it contrast with the analysis of the relationship between the indicator of monetary policy and the difference between the growth in wages and the growth in productivity.

The new results, which we obtain for the same series analyzed earlier (section 4.3.1), are in tables 5-1 and 5-2 for the U.S. and the U.K. respectively. After the use of the F-test in an analysis of covariance (sect 3.2 and appendix C), we found the best fit equation for each country to be $W^{\sim}=a+bM^{\sim}$. In reference to the tables we point to the best results for the U.S. and the U.K. respectively:

$W^{\sim} = 0.052259+0.278580M^{\sim}$

$W^{\sim} = 0.037448+0.297442M^{\sim}$

Comparing the results we had earlier in section 4.3.1 (table 4-2 and 4-3) with those obtained by conventional methods and shown in tables 5-1 and 5-2, we find a low coefficient of determination (r^2) for each country when using the conventional approach and higher coefficients when using Friedman's approach. The reasons for a low coefficient of determination are that time series reflect the impact of

Table 5-1 CONVENTIONAL METHOD FOR THE RELATIONSHIP BETWEEN THE INDICATOR OF MONETARY POLICY AND THE DIFFERENCE BETWEEN THE GROWTH IN WAGE AND THE RATE OF CHANGE IN PRODUCTIVITY, U.S.

Variables or Statistic	Equation		
	$\dot{W}=a+b\dot{M}$	$\dot{W}=a+b\dot{M}+ct$	$\dot{W}=a+b\dot{M}+ct+dt\dot{M}$
Intercept	0.052259*	0.045664*	0.045741*
$\dot{M}$	0.278580*	0.181377*	0.196990*
t	--	0.015548	0.018899
$\dot{M}t$	--	--	-0.116744*
R^2	0.1097	0.1514	0.1531
SSE	0.07512	0.07160	0.07146
TSS	0.08438	0.08438	0.08438

The asterisk means the coefficient significantly different from zero at 5% level

Table 5-2 CONVENTIONAL METHOD FOR THE RELATIONSHIP BETWEEN THE INDICATOR OF MONETARY POLICY AND THE DIFFERENCE BETWEEN THE GROWTH IN WAGE AND THE RATE OF CHANGE IN PRODUCTIVITY, U.K.

Variables or Statistic	Equation		
	$\dot{W}=a+b\dot{M}$	$\dot{W}=a+b\dot{M}+ct$	$\dot{W}=a+b\dot{M}+ct+dt\dot{M}$
Intercept	0.037448*	0.001574	0.001715
$\dot{M}$	0.297442*	0.046076*	0.007773
t	--	0.042267*	0.037677*
$\dot{M}t$	--	--	0.161990
R^2	0.0317	0.1404	0.1591
SSE	0.94118	0.83543	0.81731
TSS	0.97196	0.97196	0.97196

The asterisk means the coefficient significantly different from zero at 5% level

episodes on the data series, such as we pointed to in section 1.2, and the conventional method of proceeding directly to relate the series to one another offers no means of filtering episodic changes out of the time series in order to focus upon the isolation information of a more permanent sort. Thus, while we undertake regressions for the indicator of monetary policy (M^{-}) and the difference between the growth in wages and the growth in productivity (W^{-}) using a conventional approach, we include a lot information which is not useful for the present purpose. Via this conventional route we cannot achieve a clear permanent relationship that really matters for policy making.

In considering the uses of the alternative methods, a main question is whether Friedman's approach or H/E's yields results which mean anything in terms of policy. Although H/E notice a strong positive correlations between the series for the price, the wage rate and the money stock, H/E (1990, 11-13) did not state the conclusion that wages are exogenously determined and in turn determine the price level. Rather H/E move one step further to examine these series in ten approximately "equal-length subsamples" of the data.

Although H/E are critical of F/S's use of "phase averaging" (sect. 2.2.1) in filtering the data (sect. 2.2.2) they themselves are also engaging in data transformations in terms of what they call "equal-length subsample" as illustrated in section 2.2.3. H/E fitted regressions to the

ten resulting subsamples and claimed that " ... virtually every possible correlation between the growth rates of money and prices can be observed" (H/E 1990, 11). While H/E pointed to data transformation as losing information at the earlier time (H/E 1983, 6), now they use the method of the "equal-length subsample." The difference between this and "phase averaging" to fit a trend is that F/S calculate phase averaging base on the chronology data provided by the National Bureau of Economic Research and H/E pick up their subsample by using ambiguous, equally divided subperiod for no economic reason. What they found (1990, figure 4a and 4b, 11-13) are results which are similar to our results in table 5-1 and 5-2 for different sample periods, but they appear to offer no knowledge of the world that generated the data. Arbitrarily picking up ten different subsamples, H/E obtain every possible result, and positive and negative values for coefficient of the indicator of monetary policy (M^{-}). This effort at forcing the data into meaningless subsample provides no association with policy making of any known sort. It is "facts without theory," as Tjalling Koopmans once said of Friedman's early work (Frazer 1988, 732).

5.3 A Comparison of Results

In pointing to the inappropriateness of the conventional use of the methods, we emphasize again the superiority of Friedman's approach. He took the view that phase averaging separated the relevant information from information which may

confound estimation of the parameters. In this sense, Friedman's use of phase averaging to obtain a trend (sect. 2.2.1) is likely to result in a more stable relation than can be obtained from proceeding directly with the original, unadjusted data. This would be because the positive serial correlation within a transitory phase is reduced, and because the effects of extreme expansions and contractions are dampened.

Indeed, in board outline, the episodic part of the time series, which Friedman eliminated, is picked up by H/E. They pick up all the information F/S find irrelevant and in doing so H/E conclude with uncertain results which provided no positive policy associations.

As we may recall from section 4.3.1, we analyzed the relation between the M^{-} and the W^{-} by taking up Leamer's Extreme Bounds Analysis (EBA) and F/S's use of phase averaging in fitting trend lines and in setting the upper and lower bounds on a "true" regression coefficient. In doing this we obtain two regression equations which we have pointed to (sect. 4.3.1).

Now, we bring forward results obtained via Friedman's approach and juxtapose them in figures 5-1 and 5-2 with results obtained by H/E. With Friedman's approach we obtained upper and lower bounds for "true" regression coefficient where for both the U.S. and the U.K. a positive relationship between the M^{-} and the W^{-}. And the true regression coefficient for

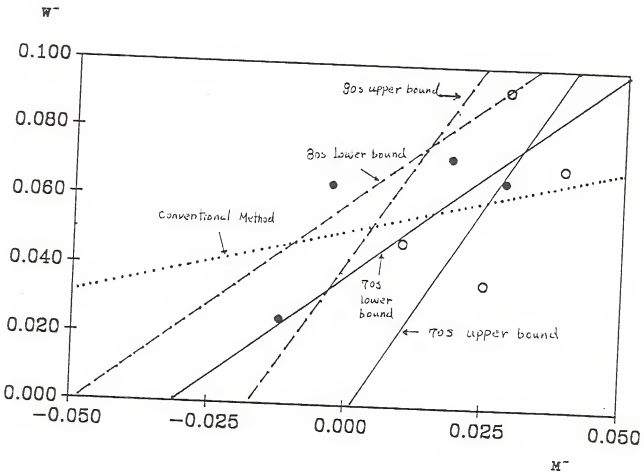

Figure 5-1 Comparison for Different Results between M^- and W^- in the United States, Friedman vs H/E

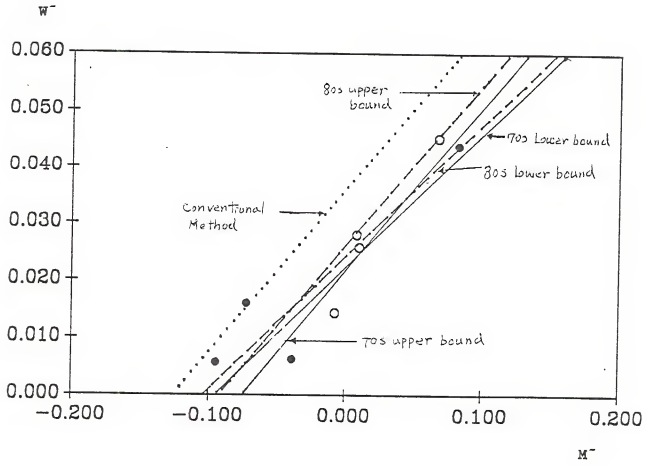

Figure 5-2 Comparison for Different Results between M⁻ and W⁻ in the United Kingdom, Friedman vs H/E

the indicator of monetary policy (M^-) lies between the upper and lower bounds of 1.146593 and 2.69167 for the U.S. and 0.231713 and 0.281988 for the U.K., respectively, which we show in figure 5-1 and 5-2 for U.S. and U.K., respectively. Here the relation between the M^- and the W^- indicates that monetary policy has a positive influence on the wage level (i.e., the wage moves positively with monetary policy). This is very much at odds with the tenet of post Keynesian economics which says that the wage is exogenously determined, that it in turn determines the price level, and that monetary policy has no influence on the price level (Rousseas 1986 74-79).

In contrast to Friedman's approach, the results obtained with the conventional approach have the following: lower coefficients of determination for both the U.S. and the U.K., and a lower and nonsignificant regression coefficient for the U.S.. These results, via the use of "the prevailing fashion in econometric work" are obtained with unfiltered time series and, in addition, take for granted an unchanging universe for the sample period (sect.5.2).

5.4 Summary

In the first chapter we point to four alternative analytical system with some claim to being positive economics. Among them there is a wide range of differences as to philosophy and uses of statistical methods. In this dissertation we juxtapose them , as sufficiently distinguished

by outside forces to provide the prospect for significant differences in the time series drawn from the respective decades, to compare Friedman's economics. Moreover, as to the four, we settle on only two of the alternatives and say that these have the most claim to some sort of relevance in the debates and controversies surrounding the implementation of policies of the kind that emerge in connection with J.M. Keynes's General Theory.

The two major alternatives are the Keynesian/post-Keynesian one and Friedman's. Furthermore, the former tends to be most readily identified with the econometric method passed along via Lawrence Klein and called "the prevailing fashion in econometric work" by Friedman, and Friedman offers his own indirect approach as embellished mainly by Frazer.

In any case, retracking these route we introduce four hypotheses which we associate with either the Keynesian/post-Keynesian approach or Friedman's approach which extends to rather different uses of statistical methods. They are

> Hypothesis 1: The United Kingdom and the United States have in common the same determinants of the money demand functions (F/S 1982, sect. 5.4).
>
> Hypothesis 2: Prices, nominal wage rates adjust more readily in the presence of monetary discipline.
>
> Hypothesis 3: Wage rates are determined by productivity and market structures irrespective of monetary policy.
>
> Hypothesis 4: Standard econometric methods are appropriate for analysis of the time series we deal

with, the hypotheses we confront, and the treatment of episodes of the kind we encounter for the decades of the 1970s and 1980s.

5.4.1 Hypothesis 1

In hypothesis 1 we offer a view which F/S advanced in Monetary Trend (1982). As we view it, their work supported the hypothesis, but we find as well that the trends and phenomena we considered offers further support for hypothesis 1. To be sure, we found the following: the highly similar policy orientations of the two countries in the 1970s and 1980s decades respectively (sect. 1.2.2, 3.2 and figures 1-1a, 1-1b); similar impacts on the data series for prices and wages (sect. 3.4.1); and shared behavior with respect to the income velocity of money (sect. 3.2).

In contrast to the F/S view, the Keynesians and the post Keynesians view velocity and much else in terms of the time series as a random walk (sect. 2.2.4). However, velocity cannot be a random walk when the two countries are sharing the same experience with respect to it and are sharing the trends in the monetary policy we point to.

5.4.2 Hypothesis 2

In hypotheses 2, we recall that Keynes pointed to "sticky wage" in the 1920s and based the General Theory on the notion of a wage standard (i.e., that wages would remain tied to productivity growth as total spending was managed to achieve Keynesian full employment.) After carefully research for the last two decades in both the United States and the United

Kingdom, we observed that nominal wage rates adjust more readily in the presence of monetary discipline, as Frazer predicted in Power and Idea (Frazer 1988, 420, 530-536, 628-629) and in Alternative Analytical System (Frazer 1991a sect. 12.3).

Both in the U.S. and in the U.K., we observed that when the indicator of monetary policy moved from accommodation to discipline era the difference between the growth in wages and the growth in productivity narrowed also. In the U.S., during the 1970s the difference between the growth in wages and the growth in productivity increased by almost one-half of a percentage point per annum, yet during the 1980s the difference between the growth in wages and the growth in productivity decreased by almost 0.8 percentage points per annum. In the U.K., during the 1970s the difference between the growth in wages and the growth in productivity increased by almost 0.15 percentage points per annum, yet during the 1980s the difference between the growth in wages and the growth in productivity decreased by almost 0.32 percentage points per annum.

The similar results for the price level and nominal wage rate (sect. 3.4.1), have given further support for hypothesis 2. In response to the accommodative monetary policy in the 1970s, we observe a positive slope for the trend line for the price averages and the trend line for the nominal wages in

both the U.S. and the U.K.. And we also observe that under the condition of monetary discipline in the 1980s the trend lines for the price series and wage series move in a negative direction for both the U.S. and the U.K. (sect.3.4.1). This finding shows that the inflation and wage rates adjust readily in the presence of monetary discipline. To be sure, the inflation and wage rates for both the U.S and the U.K. reflect the changes in monetary policy.

The foregoing findings support the second hypothesis quite strongly, and all the results we obtained have a similar pattern. Said differently, all the trends in the series were upward in the 1970s and downward in the 1980s. The implication is that the same causal force--the monetary policy-- affects the series, which underscored a stable relationship for them. And this concept of stability is arguably more realistic than the restrictive econometric definition of parameter constancy (Frazer 1988, 754).

5.4.3 Hypothesis 3

In reference to hypothesis 3, we find that the post Keynesians place monetary policy in a "sustaining" role. They do so while arguing that prices are a function of nominal wages, and wages is exogenously determined by the process of collective bargaining. They presume wage compensation is neutral with respect to the price level. In contrast, however, we proved that this argument itself is flawed (sect. 4.3 and appendix D). Indeed, wage rates are not determined by

productivity and market structures alone and irrespective of monetary policy. Rather wage rates are affected not only by productivity but also by the monetary policy and the inflation rate.

In reference to the wage bargaining process, wages are tied to labor contract and a cost of living index (Frazer 1991a, sect. 12.3). Adding Friedman's wage bargaining equation (Friedman 1969, 124), the workers take into account the rate of inflation in the wage bargain, and the price level thus gets into the process of wage bargain. As we know already from F/S's Monetary Trends, the price level is strongly influenced by monetary policy. Also from the statistical results we have with respect to the upper and lower bounds analysis for the relation between the $W^{\sim}$ and the $M^{\sim}$, we have seen that the indicator of monetary policy ($M^{\sim}$) moves the $W^{\sim}$ series not only in the U.S. but also in the U.K. This shared experience between two countries also supports hypothesis 1.

5.4.4 Hypothesis 4

Hypothesis 4 states that standard econometric methods are appropriate for analysis of the time series we deal with (sect. 1.3), the hypotheses we confront (sect. 1.1.2), and the treatment of episodes of the kind we encounter for the decades of the 1970s and 1980s for both the U.S. and the U.K. (sect. 1.2). For these countries we say episodes played a main role

in moving the time series about, and in shaping the behavior of the units comprising the economies in question.

However, the results we report from using the standard econometric methods yield both small coefficients of determination (sect. 5.2 and tables 5-1, 5-2) and ambiguous relations between the series that we examined. The reasons for the smaller coefficients of determination and the ambiguous results are (1) that time series contain changes imposed by the impacts of episodes, and (2) that conventional methods fail to filter episodic impact out of the data. Thus, via the use of the fashionable methods, episodic impacts are included. As a result, we cannot obtained a clear permanent relationship that really matters for policy making. Taking up H/E's uses as an example of an econometric approach (sect.5.2), we find the following: lower coefficients of determination for both the U.S. and the U.K., and a lower and nonsignificant regression coefficient for the U.S..

In contrast to the use of "the prevailing fashion in econometric work" approach, we have adopted Friedman's approach which gives special attention to the role of knowledge about the experiment which generates the time series data and to separating out the episodic changes in the data to find more permanent components. Via this route we find more convincing results (sect 4.3.1), namely, higher coefficient of determination (sect. 4.3.1 and 5.2); a clear positive relation

between the M^- and the W^- for both the U.S. and the U.K. (sect. 4.3.1).

APPENDIX A
EXOGENOUS AND ENDOGENOUS VARIABLES

The problem of defining an "exogenous" variable in economics started to gain visibility as the modern computer came on the scene in the early 1960s. It came initially to center about the definition of an "autonomous" variable in economics, its relation to an "exogenous" variable (said to be synonymous with "autonomous"), and the so called "big model" (Frazer 1973, sect. 4.3, 5.1, 5.2, and chap.14).

Particularly in relation to the latter, Frazer reviews the methods of solving large system of equations (1973, app. to chap.14), and later (1991a, sect 3.2) says the matter of solution for a large system of equations is not unlike that we associate with Walras's system. There is still the notion of as many non-redundant equations in the system as variables within it. These "within" variables are the so called "endogenous variables." However, there are additional notions and analytical problems in the econometric model, where a "policy" variable gets treated as an "exogenous" variables, and where the multiple regression equation arises. Viewing the multiple regression equation as follows,

$$y = a_0 + a_1x_1 + a_2x_2 + \ldots + a_nx_n + e \qquad (1)$$

y is said to be regressed on $x_1, x_2, \ldots, x_n$ to obtain estimates

for the parameters (or coefficients) a_0, a_1, a_2,..., a_n, and e is a random error term (a term to whose value only probabilities can be assigned; a term uncorrelated with any of the other variables in the equation). Along the route, an "exogenous" variable in a stochastic model, such as equation (1), is a variable whose value in each period is statistically independent of the values of the random disturbances in the model in all periods. Moreover, the term "exogenous" may refer to a variable in a system of structural equations or imply the idea of an outside variables in relation to the economic system under consideration such as the U.S. economy.

In the equation (1) instance above, there is additionally strenuous notion that effects of the x's on y may be separated via regression technique and revealed by the estimates for a_0, a_1, a_2,..., a_n. Where the estimated values for a_0, a_1, a_2,..., a_n are not stable and where the values for the error term are correlated with the variables within the model, the idea in terms of structural-equations-model thinking is to add more variables and equations to account for the instability. The general idea, in other words, is to include all endogenous variables in the structural equations model. In the work and practice of Lawrence Klein the Keynesian and big-model pioneer, we see Keynesian economics move from a two-equation IS-LM model to the 1,500 equations position of Klein's supply-demand model circa 1983 (Frazer 1984, 51-53). Such models may or may not be excessive, depending on the "purpose" at hand.

In any case, the objective is not to denigrate the models. Rather it is to consider whether economics is ready to proclaim the usefulness of such models as far as economic theory and policy are concerned.

Some main points are as follows: (1) given the way economic time series (the series which correspond to the system's inside and outside variables) move up and down together, the clarity of exogeneity is never established [at best we have degrees of exogeneity], and (2) the separate effects of the variables in the regression equation are never clearly established.

Texts authored by econometricians Maddala and Theil respectively, give very little attention to the uses-of-methods problems we point to. Even so, in connection with the standard definitions of endogenous and exogenous variables they say the following:

> A common terminology used in econometrics for dependent and independent variables is endogenous and exogenous variables, respectively. Endogenous variables are those determined within the economics system, and exogenous variables are those given from outside the system. (Maddala 1977, 5).

> The intuitive background of this distinction is that the values of certain variables (the exogenous variables) are determined "from the outside," that is, in a way which is independent of the other (endogenous) variables are determined, jointly and simultaneously, by the exogenous variables and the disturbances in the way prescribed by the equations of the system. The statistical formalization of this idea is the assumption that the values of the exogenous variables are stochastically independent of disturbances of the system. (Theil 1971, 430-431).

Moreover, Maddala said: "An instrument is an exogenous variables that is specifically manipulated so as to achieve some targets (Maddala 1977, 6). Thus, "One has to use one's judgement regarding the purpose of the investigation and the data available to decide which variables to treat as exogenous and which as endogenous" (Maddala 1977, 9). In other words, a this interpretation, the econometric technique looses its authority on an issue of central importance to "the prevailing fashion in econometric work" (Frazer 1988, 79; F/S 1982, 629).

APPENDIX B
METHOD OF PHASE AVERAGING

We follow standard NBER procedure in computing the phase as a weighted average of all observation during the phase, including both the initial and terminal points. The initial and the terminal turning point observations are weighted one-half, The intervening observations are weighted unity. The equation is

$$Y = \frac{0.5X_1 + \Sigma_2^n X_i + 0.5X_{n+1}}{n}$$

where n = duration of phase, where unit of time is interval between observations.

X_i= observations entering into phase average, where X_1 is observation at initial turning point and X_{n+1} is observation at terminal turning point.

Y = phase average.

Also we calculate the rates of change for each phase, and from phase to other phase. The reason is obvious, relative changes are the main subject of economic interest.

For example, we have table B-1 for the income phase average and the rates of change for income in each phase and growth rate for income from phase to phase. Where phase

average is in billions of current dollars. Rate of change from the initial point to the terminal point and growth rate from phase to phase are at adjusted annual rates.

Table B-1 Income Phase Average, Income Rate of Change from The Initial Point to the Terminal Point and Income Growth Rate from Phase to Phase

Phase ref. Quarter	Phase Average	Rate of Change	Growth Rate
1969IVQ - 1970IVQ	1008.8	5.4%	--
1970IVQ - 1973IVQ	1208.9	12.3%	9.9%
1973IVQ - 1975IQ	1472.0	6.3%	10.2%
1975IQ - 1980IQ	1949.6	15.0%	10.8%
1980IQ - 1980IIIQ	2687.8	4.5%	13.7%
1980IIIQ- 1981IIIQ	2940.4	13.3%	12.5%
1981IIIQ- 1982IVQ	3144.3	3.6%	6.1%
1982IVQ - 1989IIQ	4178.2	9.4%	8.4%

APPENDIX C
TESTING FOR THE BEST FIT TREND LINE

In this appendix we are going to explain how we pick up the best fit (minimum least squares, most significant) trend shown in sections 3-2, 3-4a, 4-3a and 5-2 rather than the other trend lines shown in the following tables. There are two hypotheses used in testing the relation between variables which will determine the best fit trend line. In the present case we are dealing with trend lines for the entire sample period and the sample periods we select (namely the 1970s and 1980s; sect.1.2a) and the two hypotheses are (1) that the right-hand side variables are interacting and (2) that they are not interacting. The test of the hypotheses reduces to one test, namely the F-test (Frazer 1973, 42) which analyzes and compares variance among different models. The F-test will assure the relation of the trend line that best fits the data.

In using the "F-test" we undertake a comparison of equations where one is called the complete model and the other the reduced model. In the complete model we are adding variables to the reduced, to determine whether the addition of the variables improves the fit of the line (or plane) to the data.

In the particular cases at hand, we have the following:

Set I $\quad \tilde{M}=a+bt$

$\tilde{M}=a+bt+cZ$

$\tilde{M}=a+bt+cZ+dtZ$

Set II $\quad \tilde{W}=a+bt$

$\tilde{W}=a+bt+cZ$

$\tilde{W}=a+bt+cZ+dtZ$

In these sets of equations we have $\tilde{M}$, the indicator of monetary policy, $\tilde{W}$, the difference between the growth in wage and the rate of change in productivity, t, as time, Z, a dummy variable when data we have is picking up from the 1970s then it equals to one otherwise it equals to zero. Plus we have split the sample period 1970 to 1990 into two sub periods, with the view to doing two things (1) improving the fit of the trend lines, and (2) ultimately testing the hypothesis that the universe for the 1970s is different from that of the 1980s (sect.1.2a), making the comparisons within each set of equations we are left with the best fit trend line. The "F value" for the selection of the best fit trend line is, in general terms,

$$F = \frac{(SSE_R - SSE_C)/(k - g)}{SSE_C/[N - (k+1)]}$$

where k and g are the numbers of independent variables in the two different models, SSE_R and SSE_C are the sums of squared errors for the reduced and complete models, and $df_1 = k - g$ and $df_2 = N - (k+1)$. In the specific cases where we have obtained "F value" for the U.S. and the U.K. and for the two

sets of equations above, so we have four different tables showing the statistical results obtained for the best trend lines. Example of the "F values" obtained in arriving at the results in the four different tables below are as follows:

Table C-1

$$F = \frac{(SSE_R - SSE_c)/(k - g)}{SSE_c/[N - (k+1)]} = \frac{(0.07416-0.05186)/1}{0.05186/73}$$

$$= 31.39$$

a large and significant value. That tells us the trend line for the difference between the wage rate and the rate of change in productivity is significantly different between the last two decades, during the 1970s (monetary accommodation) the trend was upward by almost 0.5 percent every quarter. Yet, moving into the 1980s (monetary discipline) the trend was downward by almost 0.8 percent every quarter, shown as figure 4-2a. And equation $W^{\cdot}=a+bt+cZ+dtZ$ does give a significant improvement in the fit than equations $W^{\cdot}=a+bt+cZ$, or $W^{\cdot}=a+bt$, shown as figures C-1 and C-2.

Table C-2

$$F = \frac{(SSE_R - SSE_c)/(k - g)}{SSE_c/[N - (k+1)]} = \frac{(0.02288-0.01962)/1}{0.01962/74}$$

$$= 12.3$$

a large and significant value. That tells us the trend line for the difference between the wage rate and the rate of change in productivity is significantly different between the last two decades. During the 1970s (monetary accommodation)

the trend line was upward by almost 0.15 percent every quarter. Yet, turn into the 1980s (monetary discipline) the trend line was downward by almost 0.32 percent every quarter. And equation $\tilde{W}=a+bt+cZ+dtZ$, shown as figure 4-2b, does give a significant improvement in the fit than equation $\tilde{W}=a+bt+cZ$ and $\tilde{W}=a+bt$, shown as figures C-3, C-4.

Table C-3

$$F = \frac{(SSE_R - SSE_C)/(k - g)}{SSE_C/[N - (k+1)]} = \frac{(0.09706-0.09186)/1}{0.09186/74}$$

$$= 4.18$$

a significant value. That tells us the trend line for the indicator of monetary policy is significantly different between 1970s and 1980s (sect. 1.2a). And equation $\tilde{M}=a+bt+cZ+dtZ$, as shown in figure 1-1a, is more fit than equation $\tilde{M}=a+bt+cZ$ and $\tilde{M}=a+bt$, shown as in figures C-5 and C-6, for describing the trend for the indicator of monetary policy.

Table C-4

$$F = \frac{(SSE_R - SSE_C)/(k - g)}{SSE_C/[N - (k+1)]} = \frac{(0.25376-0.18804)/1}{0.18804/74}$$

$$= 25.86$$

a significant value. That tells us the trend line for the indicator of monetary policy is significantly different between 1970s and 1980s (sect. 1.2a). And equation $\tilde{M}=a+bt+cZ+dtZ$, as shown in figure 1-1b, is more fit than equation $\tilde{M}=a+bt+cZ$ and $\tilde{M}=a+bt$, shown as in figures C-7 and

C-8, for describing the trend for the indicator of monetary policy.

The tables and figures follow.

Table C-1 SUMMARY FOR FITTING MODEL FOR THE TREND LINE FOR THE DIFFERENCE BETWEEN THE WAGES AND THE GROWTH IN PRODUCTIVITY, U.S.

Variables or Statistic	Equation		
	$\bar{W}=a+bt$	$\bar{W}=a+bt+cZ$	$\bar{W}=a+bt+cZ+dtZ$
Intercept	3.948316	1.694475	15.330757
t	-0.1966	-0.0831	-0.7703
Z	--	1.458256	11.360698
tZ	--	--	1.2309
R^2	0.1089	0.1211	0.3853
SSE	0.07519	0.07416	0.05186
TSS	0.08438	0.08438	0.08438

Table C-2 SUMMARY FOR FITTING MODEL FOR THE TREND LINE OF THE DIFFERENCE BETWEEN THE WAGES AND THE GROWTH IN PRODUCTIVITY, U.K.

Variables or Statistic	Equation		
	$\bar{W}=a+bt$	$\bar{W}=a+bt+cZ$	$\bar{W}=a+bt+cZ+dtZ$
Intercept	3.014804	3.425262	2.368125
t	-1.6061	-0.0844	0.1325
Z	--	-0.773223	3.735309
tZ	--	--	-0.4508
R^2	0.1792	0.1952	0.3098
SSE	0.02334	0.02288	0.01962
TSS	0.02843	0.02843	0.02843

Table C-3 SUMMARY FOR FITTING MODEL FOR THE TREND LINE FOR THE INDICATOR OF MONETARY POLICY, U.S.

Variables or Statistic	Equation		
	$M^{-}=a+bt$	$M^{-}=a+bt+cZ$	$M^{-}=a+bt+cZ+dtZ$
Intercept	5.251395	-1.320804	2.558236
t	-0.2645	0.0664	-0.1794
Z	--	0.043035	-0.118135
tZ	--	--	0.4566
R^2	0.1401	0.2133	0.2554
SSE	0.10610	0.09706	0.09186
TSS	0.12338	0.12338	0.12338

Table C-4 SUMMARY FOR FITTING MODEL FOR THE TREND LINE FOR THE INDICATOR OF MONETARY POLICY, U.K.

Variables or Statistic	Equation		
	$M^{-}=a+bt$	$M^{-}=a+bt+cZ$	$M^{-}=a+bt+cZ+dtZ$
Intercept	6.455145	7.220576	22.53880
t	-0.7161	-0.7767	-1.8899
Z	--	0.007891	-20.939677
tZ	--	--	2.0675
R^2	0.3328	0.3336	0.5062
SSE	0.25407	0.25376	0.18804
TSS	0.38077	0.38077	0.38077

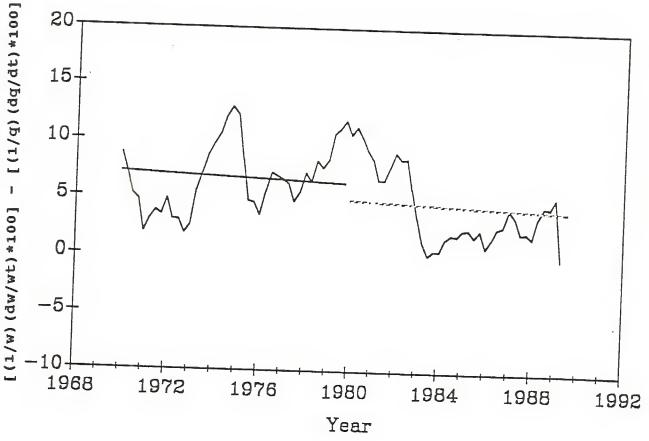

Figure C-1 The Trend line for W^{-}, as $W^{-} = a + bt + cZ$
United States

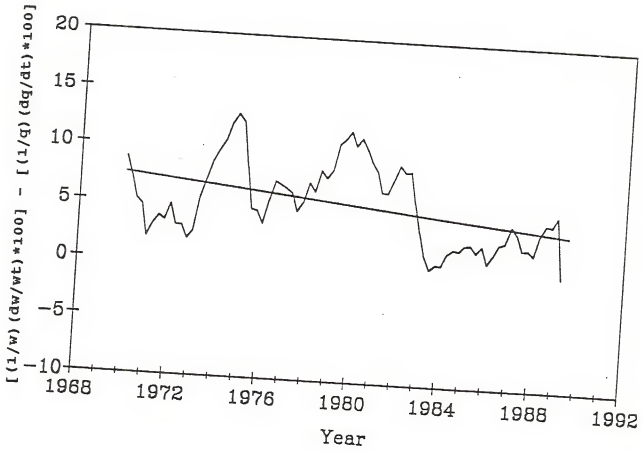

Figure C-2 The Trend line for $\bar{W}$, as $\bar{W} = a + bt$
United States

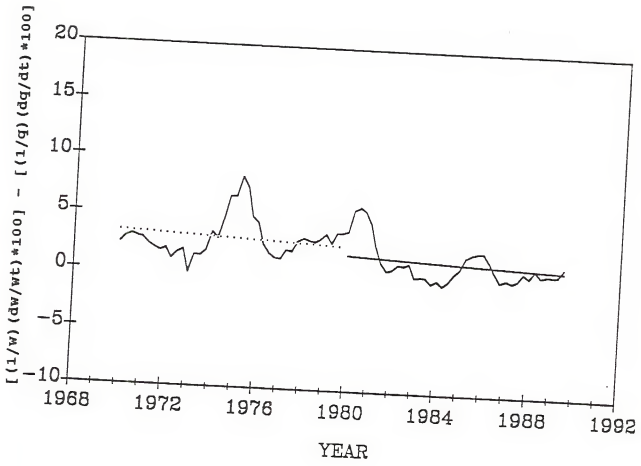

Figure C-3 The Trend line for W^{-}, as $W^{-} = a + bt + cZ$
United Kingdom

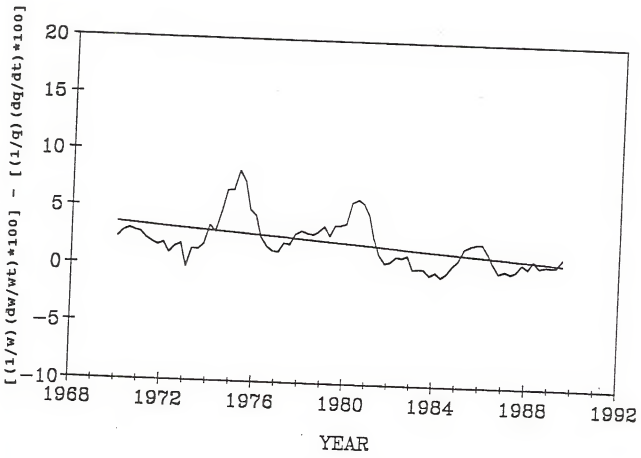

Figure C-4 The Trend line for W^{-}, as $W^{-} = a + bt$
United States

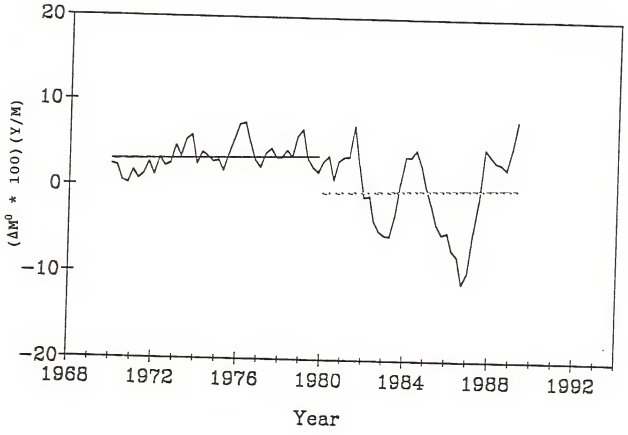

Figure C-5 The Trend line for M^{-}, as $M^{-} = a + bt + cZ$
United States

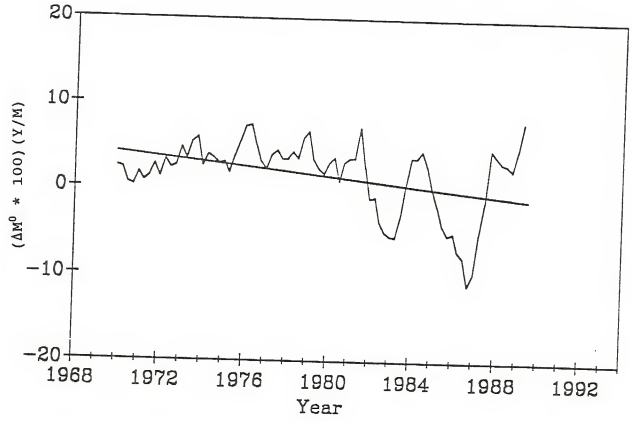

Figure C-6 The Trend line for M^{-}, as $M^{-} = a + bt$
United States

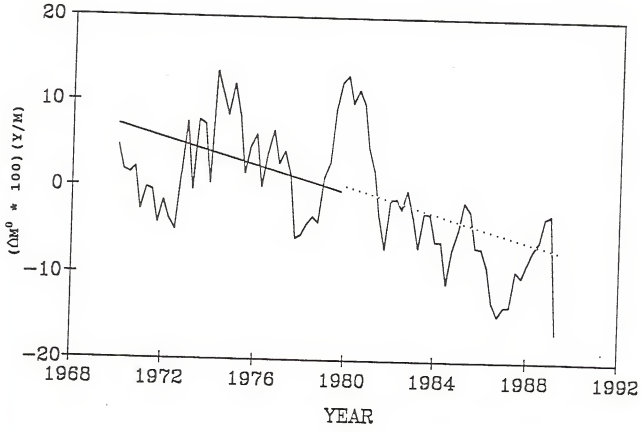

Figure C-7 The Trend line for $\bar{M}$, as $\bar{M} = a + bt + cZ$
United Kingdom

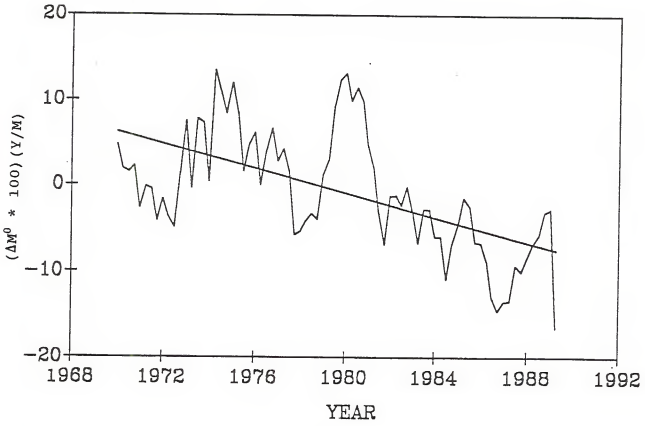

Figure C-8 The Trend line for M^-, as $M^- = a + bt$
United States

APPENDIX D
WAGE COMPENSATION PRICE NEUTRAL ?

The post Keynesians in order to put monetary policy into a "sustaining" roles claims that prices are a function of nominal wages, and wage is exogenously determined by the process of collective bargaining. Which they presume wage compensation is price neutral. The view emerged that compensation of money wage earners according to the average of rate of productivity growth was neutral with respect to the price level, ceteris paribus, where the sectoral weights attached to the individual prices and rates of productivity growth were the initial sectoral shares of value added. This contention is easily demonstrated in a one-sector model, even in the presence of nonlabor (e.g., raw material or agricultural) variables costs of production, because the compensation rule maintains real per unit labor costs. However, in a multisectoral model this contention does not hold even in the absence of nonlabor variables costs of production, this shows that the theory itself is flawed.

Along this line, we recall Rousseas-Weintraub wage theorem, namely:

$$P = k\ (W/Q)$$

$$= k\ (W/L)/(Q/L) \qquad (1)$$

Which can be rewritten as the prices of consumption (C) and

investment (I) goods, that will be able to a multisectoral analysis:

$$p_i = (1+u_i)\ mw_i L_i/Q_i \qquad (i = C, I) \qquad (2)$$

where mw_i, L_i, Q_i and u_i are , respectively, the money wage per worker, employment, real output, and the mark-up in sector i (i = C, I).

Given constant u_i then the rate of change of p_i may be written as:

$$p_i^0 = mw_i^0 + (L_i/Q_i)^0 \qquad (i = C, I) \qquad (3)$$

where the ^{0} notation denotes the rate of change of the variable.

Denote the price index by P where

$$P = sp_I + (1-s)p_C \qquad (4)$$

and the constant weight s represents the initial share of value of added produced in sector I; that is,

$$s = p_I^1 Q_I^1 / Y^1 \qquad (5)$$

where Y^1 denotes total value added the total output of consumption and investment goods.

The symbol A^0 donates the average economy-wide rate of productivity change where

$$A^0 = s(Q_I/L_I)^0 + (1-s)(Q_C/L_C)^0 \qquad (6)$$

the same sectoral weights are used in the computation of the price index and the average rate of productivity growth. Utilizing (3), (4) we can show that

$$P^0 = sp_I p_I^0/P + (1-s)p_C p_C^0/P \qquad (7)$$

where the time superscripts have been erased for simplicity.

If the average-productivity rule ($A^0 = mw_i{}^0$) is applied then wages in each sector are increased at rate a rate A^0 so that from (6), (2) and (3)

$$P^0 = (sp_I/P)[A^0+(L_I/Q_I)^0] + [(1-s)p_c/P][A^0+(L_c/Q_c)^0]$$

$$= [s(1-s)/P][(Q_c/L_c)^0-(Q_I/L_I)^0](p_I-p_c) \qquad (8)$$

The inflation rate is zero either if the prices in each sector are equal or in the case of equal rates of productivity growth in each sector so that the prices p_I, p_c are restored by the adjustment rule, as in the single sector case. However, even if p_I, p_c are equal in the initial period, different rates of price change in the two sectors, caused by unequal rates of labor productivity growth will ensure their subsequent inequality. Period by period application of the adjustment rule will be non-neutral with respect to the price level due to the divergence of p_I and p_c. Hence, wage adjustment according to economy-wide productivity growth is not neutral which contradicts to the assumption of the post Keynesians (Rousseas 1986, 74) with respect to the price level because the weights applied to sectoral productivity growth rates do not equal to the corresponding weights in the calculation of the inflation.

APPENDIX E
TESTING FOR DIFFERENCE IN AVERAGE VALUES
FOR THE 1970S AND 1980S RESPECTIVELY: M^- AND W^-

We see the value difference exists between two different regimes in the mean of the indicator of monetary policy and the mean of the difference between the wage rate and the productivity rate both in the United States and in the United Kingdom. One question comes up into our mind. Are these differences significantly different toward one another ? In the following sections we intend to answer this question. The most common procedure for comparing two groups on a characteristic measured on at least an interval scale is to make inferences about their means and the difference between them. Let μ_1 equals to mean of the indicator of monetary policy for 1970s, and μ_2 equals to mean of the indicator of monetary policy for 1980s. We shall first consider the situation in which the samples are obtained independently, and the samples sizes are sufficiently large to obtain a normal sampling distribution.

From the Central Limit Theorem, we know that if the samples size n_1 of the first group is sufficiently large, the sampling distribution of $\hat{u}_1$ is approximately normal about μ_1 with variance $\delta^2_{\hat{u}1} = \delta^2_1/n_1$, where δ^2_1 is the population variance for that group. Similarly, The sampling distribution of $\hat{u}_2$ is

approximately normal about μ_2 with variance $\delta^2_{\hat{u}2} = \delta^2_2/n_2$, if n_2 is sufficiently large. $\hat{u}_2 - \hat{u}_1$, an unbiased point estimator of $\mu_2 - \mu_1$, has a sampling distribution that is approximately normal about $\mu_2 - \mu_1$ with standard deviation

$$\delta_{\hat{u}2-\hat{u}1} = \sqrt{(\delta^2_{\hat{u}1}+\delta^1_{\hat{u}2})} = \sqrt{(\delta^2_1/n_1 + \delta^2_2/n_2)}$$

This leads us to the form for a confidence interval for $\mu_2-\mu_1$

$$(\hat{u}_2 - \hat{u}_1) \pm z_{a/2}\delta_{\hat{u}2-\hat{u}1}$$

As usual, we take the best point estimate of $\mu_2 - \mu_1$, and add and subtract a z-score multiplied by the standard deviation of the estimate. The theoretical formula for the standard deviation involves the population variances δ^2_1 and δ^2_2, which are nearly always unknown in applications. In the large-sample case considered here, we can substitute the sample variances σ^2_1 and σ^2_2 as point estimates for δ^2_1 and δ^2_2 in the formula for $\delta_{\hat{u}2-\hat{u}1}$ without significantly affecting the results.

As a point estimated of $\mu_2 - \mu_1$ (where μ_2 is the mean of the indicator of monetary policy for 1980s, and μ_1 is the mean of the indicator of monetary policy for 1970s) , the difference in the mean of the indicator of monetary policy for the 1970s to the 1980s in the United States, we would use $\hat{u}_2 - \hat{u}_1 = -0.267\% - 3.388\% = -3.655\%$. A 99% confidence interval for $\mu_2 - \mu_1$ is

$$(-3.655\%) \pm 2.58\ \sqrt{[(1.760\%)^2/40 + (4.800\%)^2/38]}$$

$$= -3.655\% \pm 2.58\ \sqrt{[0.00683\%]}$$

$$= -3.655\% \pm 2.132\%$$

$$= (\ -5.787\%\ ,\ -1.523\%\ )$$

Since the confidence interval for $\mu_2 - \mu_1$ contains only negative values, we are essentially concluding that μ_2 is smaller than μ_1 at 99% confidence level. That means the mean of the indicator of monetary policy for 1980s is smaller than that for 1970s.

Also we test H_o: $\mu_2 = \mu_1$ against H_a: $\mu_2 < \mu_1$. The alternative hypothesis reflects the mean of the indicator of monetary policy for 1970s have larger mean, that means during 1970s monetary policy is more accommodative than 1980s. Now,

$$\sigma_{\hat{u}2-\hat{u}1} = \sqrt{[0.00683\%]}$$

so that

$$z = [\hat{u}_2 - \hat{u}_1]/\sigma_{\hat{u}2-\hat{u}1} = -[3.655\%]/\sqrt{[0.00683\%]} = -4.42$$

For this test, the P-value would be P = 0.00003. Thus, there is substantial evidence that the indicator of monetary policy for 1970s have larger mean than that for 1980s. Which also means that in the 1970s monetary policy is more accommodative than in the 1980s.

Like the previous section we test the monetary policy indicator between 1970s and 1980s for the United Kingdom also. As a point estimated of $\mu_4 - \mu_3$ (where μ_4 is the mean of the indicator of monetary policy for 1980s, and μ_3 is the mean of the indicator of monetary policy for 1970s), the difference in the mean of the indicator of monetary policy for the 1970s and the 1980s in the United Kingdom, we would use $\hat{u}_4 - \hat{u}_3 = -4.141\% - 2.642\% = -6.783\%$. A 99% confidence interval for $\mu_4 - \mu_3$ is

$$(-6.783\%) \pm 2.58 \sqrt{[(5.290\%)^2/40 + (4.287\%)^2/38]}$$

$= -6.783\% \pm 2.58\ \sqrt{[0.01182\%]}$

$= -6.783\% \pm 2.806\%$

$= (-9.589\% , -3.977\%)$

Since the confidence interval for $\mu_4 - \mu_3$ contains only negative values, we are essentially concluding that μ_4 is smaller than μ_3 at 99% confidence level. That means the mean of the indicator of monetary policy for 1980s is smaller than that for 1970s in the United Kingdom also.

And we test H_o: $\mu_4 = \mu_3$ against H_a: $\mu_4 < \mu_3$. The alternative hypothesis reflects the mean of the indicator of monetary policy for 1970s have larger mean, that means during 1970s monetary policy is more accommodative than 1980s. Now,

$\sigma_{\hat{u}_4 - \hat{u}_3} = \sqrt{[0.01182\%]}$

so that

$z = [\hat{u}_4 - \hat{u}_3]/\sigma_{\hat{u}_4 - \hat{u}_3} = -[6.783\%]/\sqrt{[0.01182\%]} = -6.236$

For this test, the P-value would be P = 0.000001 Thus, there is substantial evidence that the indicator of monetary policy for 1970s have larger mean than that for 1980s. Which also means that during the 1970s monetary policy is more accommodative than monetary policy in the 1980s in the United Kingdom.

Let μ_5 equals to mean of the difference between the growth in wage and the rate of change in productivity for 1970s, and μ_6 equals to mean of the difference between the growth in wage and the rate of change in productivity 1980s. As a point estimated of $\mu_6 - \mu_5$, the change of the mean of the

difference between the growth in wage and the rate of change in productivity between the 1970s and the 1980s, we would use $\hat{u}_6 - \hat{u}_5 = 4.477\% - 6.735\% = -2.258\%$. A 99% confidence interval for $\mu_6 - \mu_5$ is

$$(-2.258\%) \pm 2.58 \sqrt{[(3.052\%)^2/40 + (3.259\%)^2/38]}$$
$$= -2.258\% \pm 2.58 \sqrt{[0.00511\%]}$$
$$= -2.258\% \pm 1.845\%$$
$$= (-4.103\% , -0.413\%)$$

Since the confidence interval for $\mu_6 - \mu_5$ contains only negative values, we are essentially concluding that μ_6 is smaller than μ_5 at 99% confidence level. This means the mean of the difference between the growth in wage and the rate of change in productivity for 1980s is smaller than the mean of the difference between the growth in wage and the rate of change in productivity for 1970s in the United States. Yet, into the 1980s these two growth rates obviously get closer. Thus, when we make a point estimated of $\mu_6 - \mu_5$, we have all negative estimated values.

Also we test H_o: $\mu_6 = \mu_5$ against H_a: $\mu_6 < \mu_5$. The alternative hypothesis reflects the mean of the difference between the growth in wage and the rate of change in productivity for 1970s larger than the mean of the difference between the growth in wage and the rate of change in productivity for 1980s. Now,

$$\sigma_{\hat{u}6-\hat{u}5} = \sqrt{[0.00511\%]}$$

so that

$z = [\hat{u}_6 - \hat{u}_5]/\sigma_{\hat{u}6-\hat{u}5} = -[2.258\%]/\sqrt{[0.00511\%]} = -3.15$

For this test, the P-value would be P = 0.00053. Thus, there is substantial evidence that the difference between the growth in wage and the rate of change in productivity for 1970s have larger mean than the difference between the growth in wage and the rate of change in productivity for 1980s in the United States.

Let μ_7 equals to mean of the difference between the growth in wage and the rate of change in productivity for 1970s, and μ_8 equals to mean of the difference between the growth in wage and the rate of change in productivity 1980s. As a point estimated of $\mu_8 - \mu_7$, the change in the mean of the difference between the growth in wage and the rate of change in productivity for the 1970s to the 1980s, we would use $\hat{u}_8 - \hat{u}_7 = 1.407\% - 3.014\% = -1.607\%$. A 99% confidence interval for $\mu_8 - \mu_7$ is

$(-1.607\%) \pm 2.58\ \sqrt{[(3.014\%)^2/40 + (1.407\%)^2/38]}$

$= -1.607\% \pm 2.58\ \sqrt{[0.00279\%]}$

$= -1.607\% \pm 1.363\%$

$= (-2.970\% , -0.244\%)$

Since the confidence interval for $\mu_8 - \mu_7$ contains only negative values, we are essentially concluding that μ_8 is smaller than μ_7 at 99% confidence level. This means the mean of the difference between the growth in wage and the rate of change in productivity for 1980s is smaller than the mean of the difference between the growth in wage and the rate of

change in productivity for 1970s in the United Kingdom.

Also we test H_o: $\mu_8 = \mu_7$ against H_a: $\mu_8 < \mu_7$. The alternative hypothesis reflects the mean of the difference between the growth in wage and the rate of change in productivity for 1970s larger than the mean of the difference between the growth in wage and the rate of change in productivity for 1980s. Now,

$$\sigma_{\hat{u}8-\hat{u}7} = \sqrt{[0.00279\%]}$$

so that

$$z = [\hat{u}_8 - \hat{u}_7]/\sigma_{\hat{u}8-\hat{u}7} = -[1.607\%]/\sqrt{[0.00279\%]} = -3.04$$

For this test, the P-value would be P = 0.00083. Thus, there is substantial evidence that the difference between the growth in wage and the rate of change in productivity for 1970s have larger mean than the difference between the growth in wage and the rate of change in productivity for 1980s.

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Peng Cheng Wen was born in Taiwan, Republic of China. He received his undergraduate degree in economics at the National Taiwan University in 1980. He is married, and 32 years old. In this coming spring, he is to be an assistant professor in economics at Pacific College in Fresno, California.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

William Frazer, Chairman
Professor of Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Sanford Berg
Professor of Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Leonard Cheng
Associate Professor of Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Graduate Faculty of the Department of Economics in the College of Business Administration and to the Graduate school and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

May, 1991

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